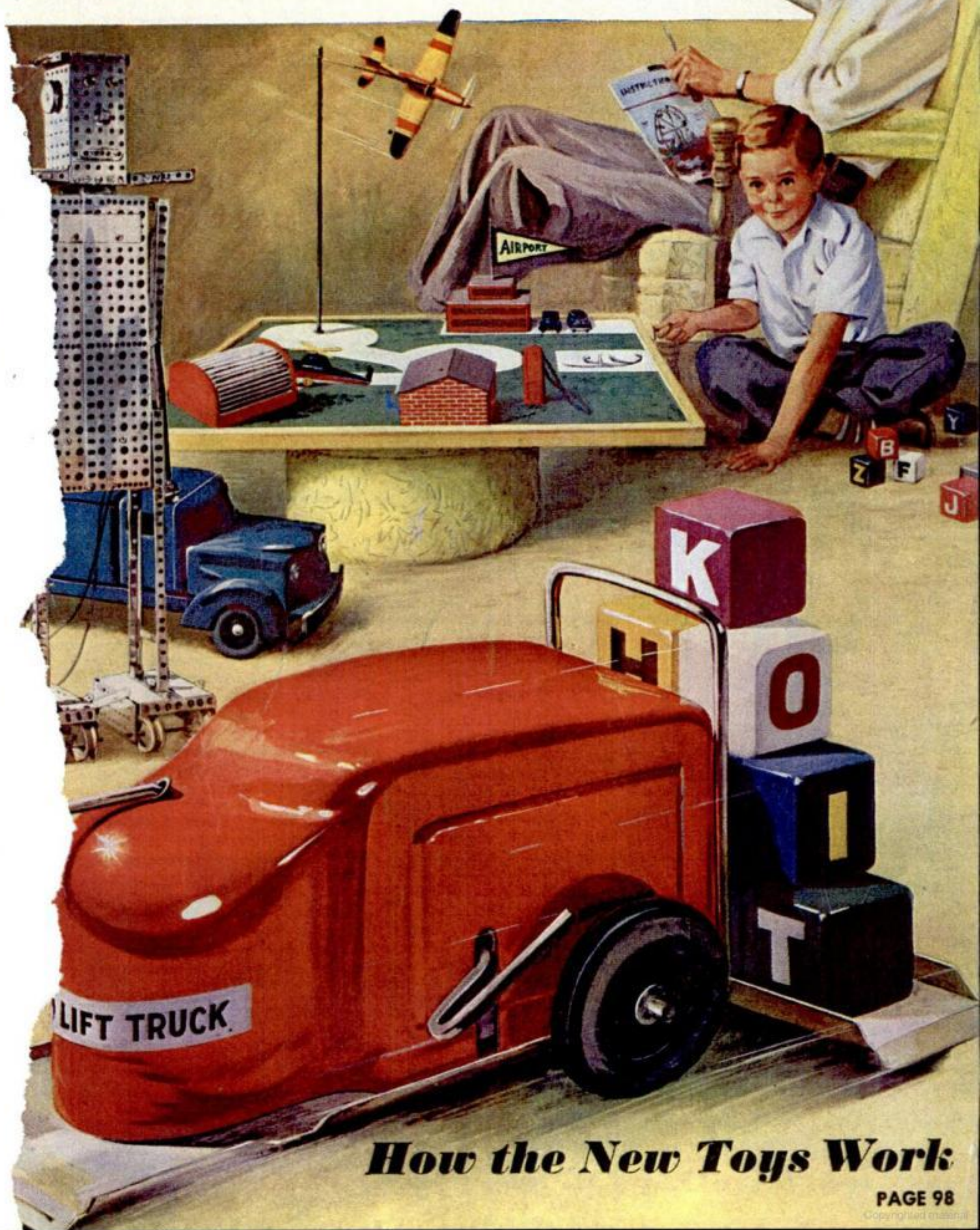


POPULAR SCIENCE

Dec. 1946

25¢

Monthly



How the New Toys Work

PAGE 98

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The Birth of Precision

12 HAIRBREADTHS = 1 POPPY SEED
 4 POPPY SEEDS = 1 BARLEY CORN
 3 BARLEY CORNS, END TO END = 1 INCH
 (First used in England, early 16th Century)

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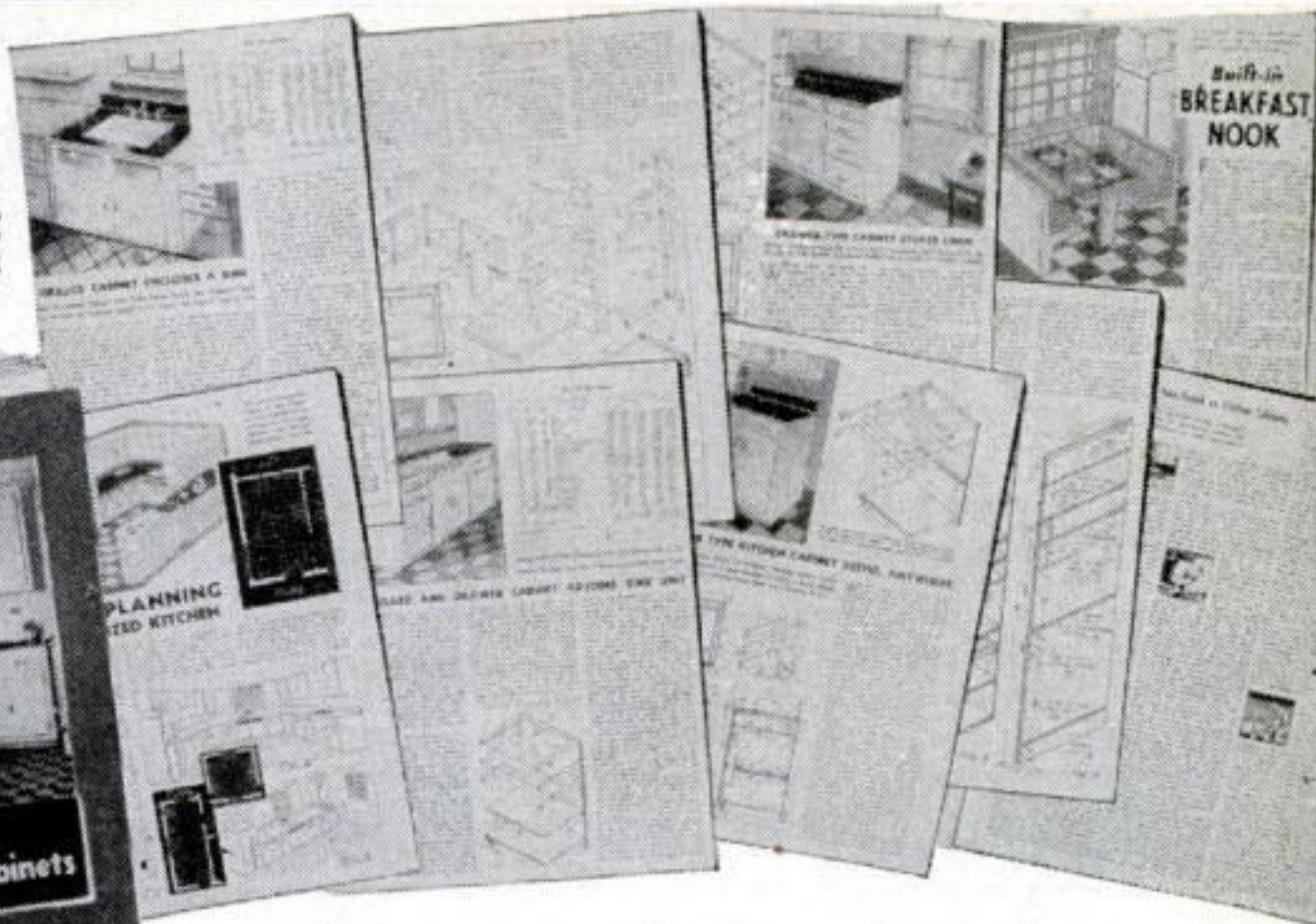
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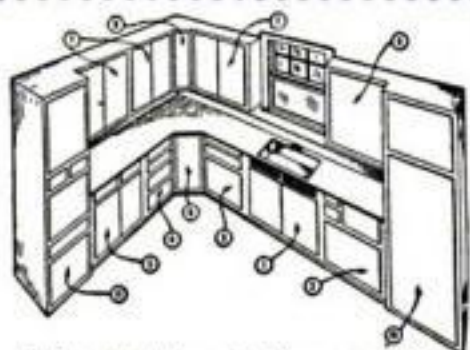
TYPICAL kitchen schemes shown here are but a few of many, many combinations you can have by selecting cabinets for your own special needs and in widths that fit your available space



PLAN A is a suggested arrangement if you have two adjacent walls for cabinets. PLAN B gets a wide variety of cabinets into compact space along one wall. PLAN C has broom closet



PLAN D has cabinets along one wall and utilizes corner for convenient dinette. PLAN E is laid out on the efficient U principle around three walls. Built-in breakfast nook included



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VOL. 153: NO. 6

POPULAR SCIENCE

MECHANICS AND HANDICRAFT

Monthly

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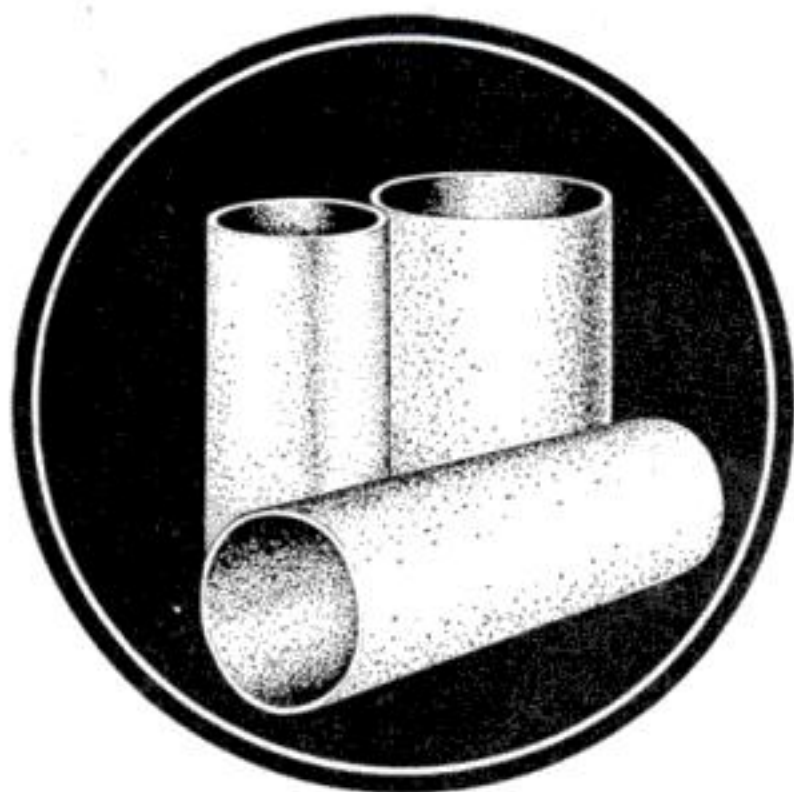
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Continued on page 4

Popular Science Monthly is published monthly at 353 Fourth Avenue, New York 10, N. Y., by Popular Science Publishing Co., Inc., Godfrey Hammond, President and Treasurer; R. C. Wilson, Raymond J. Brown, Stephen P. Glennon, Vice-Presidents; F. W. Briggs, Secretary. Entered as second-class matter Dec. 28, 1918, re-entered as second-class matter July 26, 1948, at the Post Office in New York, N. Y., under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada, Printed in U.S.A. Copyright, 1948, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and Pan-American Copyright Convention. Yearly subscriptions to United States, its possessions and Canada, \$3.00 (2 years, \$5.50; 3 years, \$7.50); foreign countries \$1 per year extra. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new addresses, including zone numbers. Vol. 153: No. 6.

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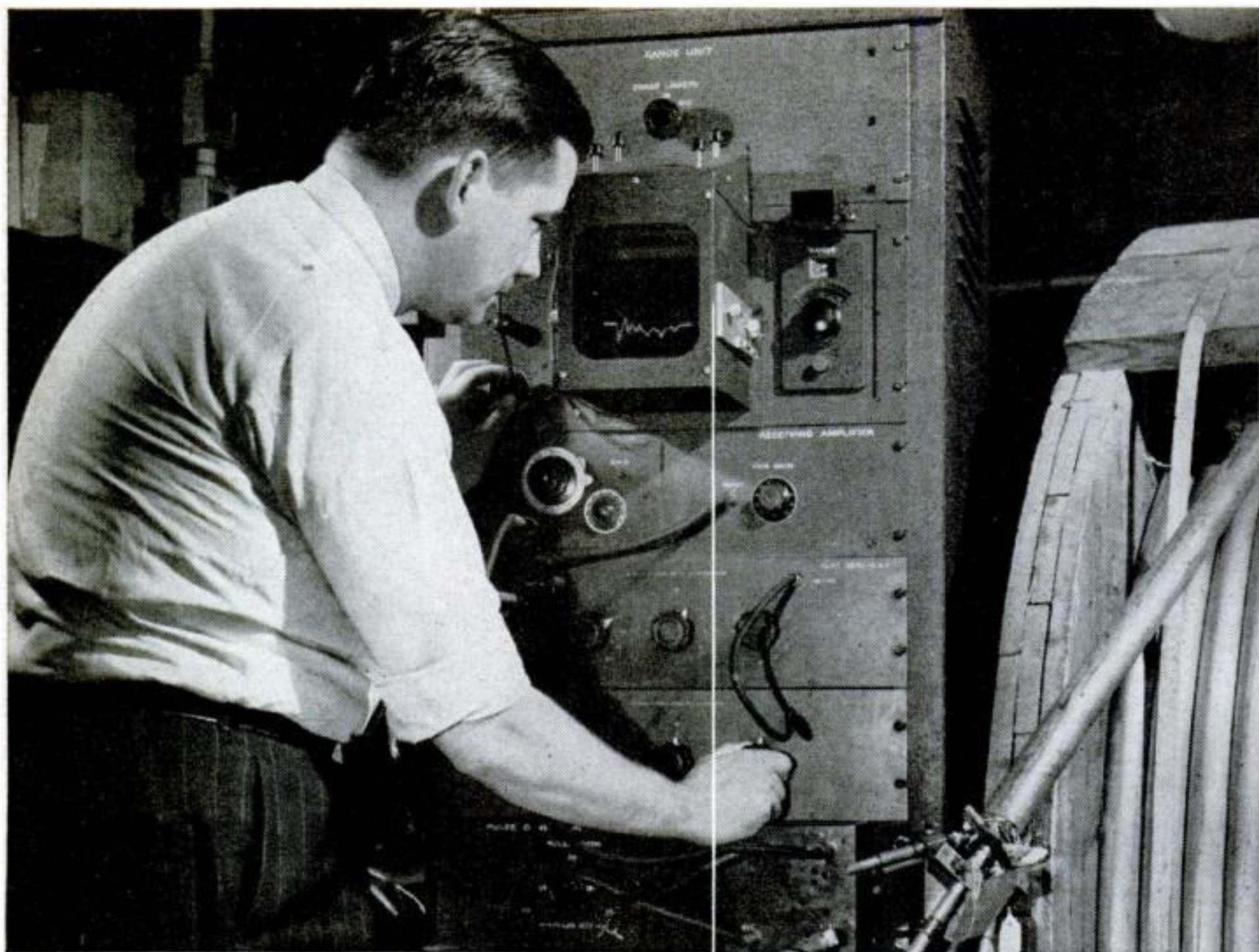
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Under the LaSalle Problem Method you pursue, to all intents and purposes, that identical plan. You advance by solving problems.

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Thus—instead of fumbling and blundering—you are coached in the solving of the very problems you must face in the higher accounting positions or in an accounting practice of your own. Step by step, you work them out for yourself—until, at the end of your training, you have the kind of ability and experience for which business is willing and glad to pay real money.

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For Accountancy is no magic wand for the lazy or the fearful or the quitter—it offers success only to the alert adult who has the courage to face the facts and the will to carry on till the job is done.

If you are that individual, the coupon below, filled out and mailed, will bring you free the information that may open up to you the future of which you have dreamed—ability and income and success. Is it not worth getting that information?

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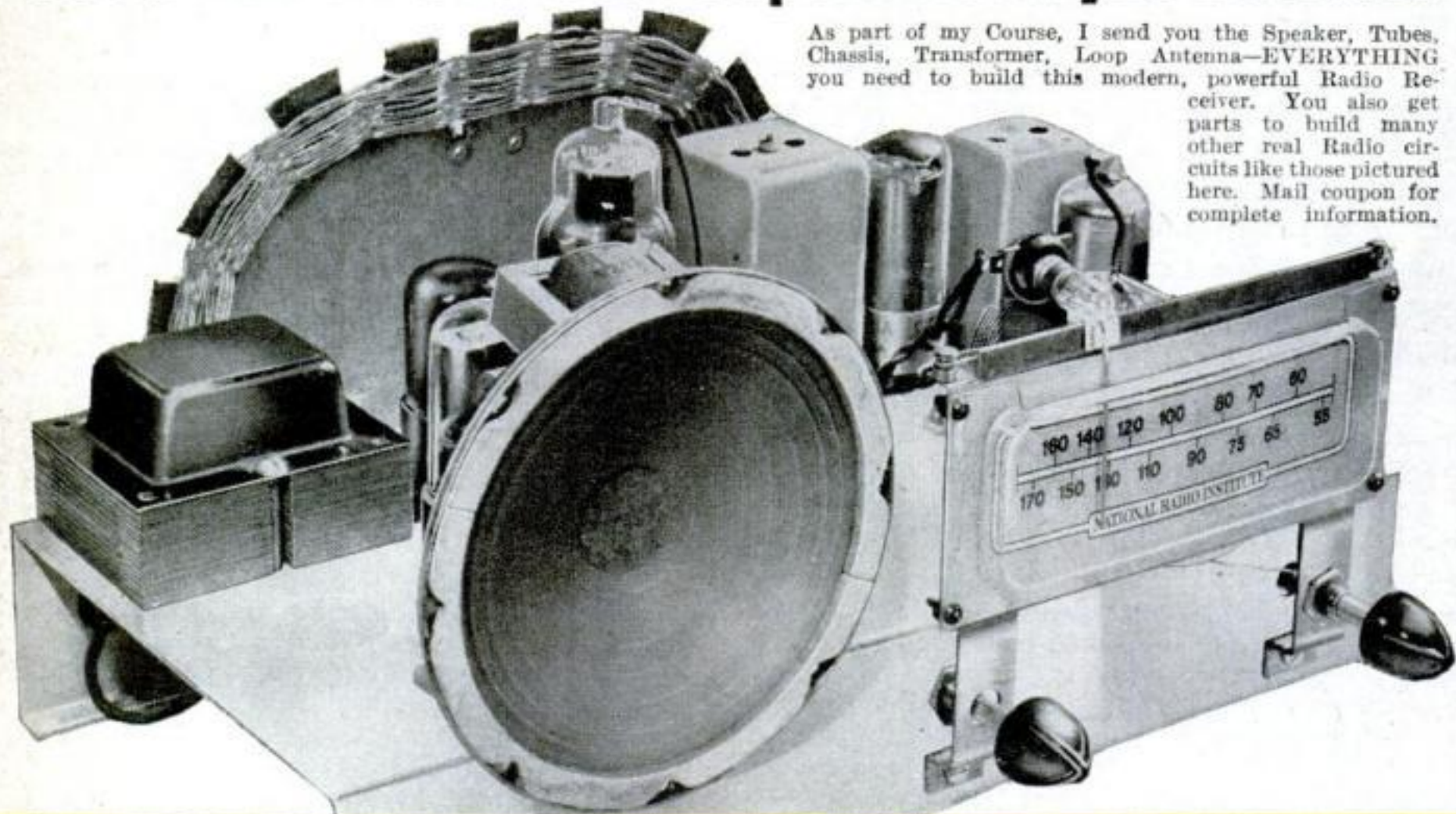
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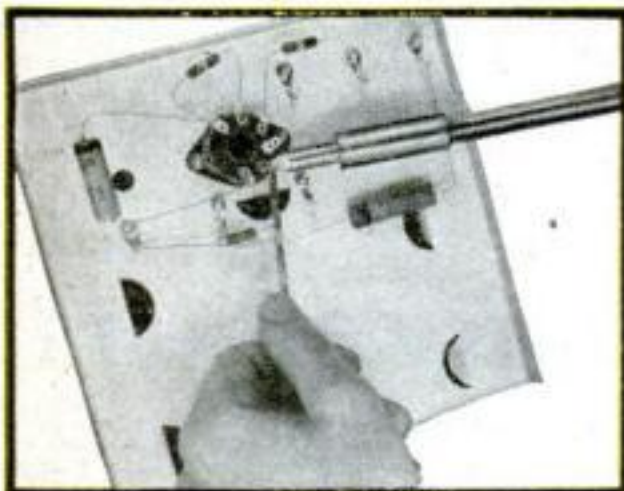
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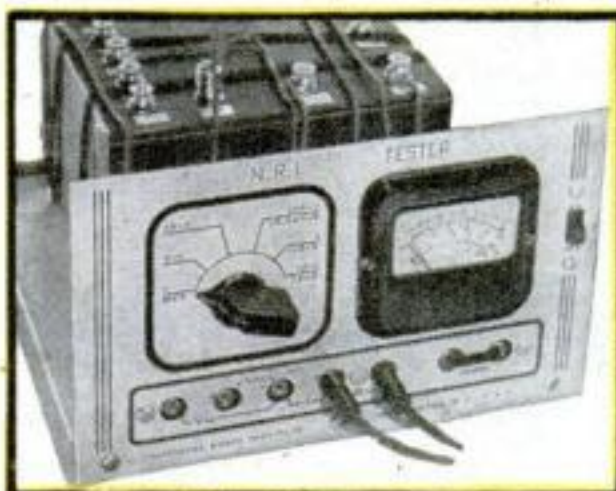
You Build This Modern Superheterodyne Receiver



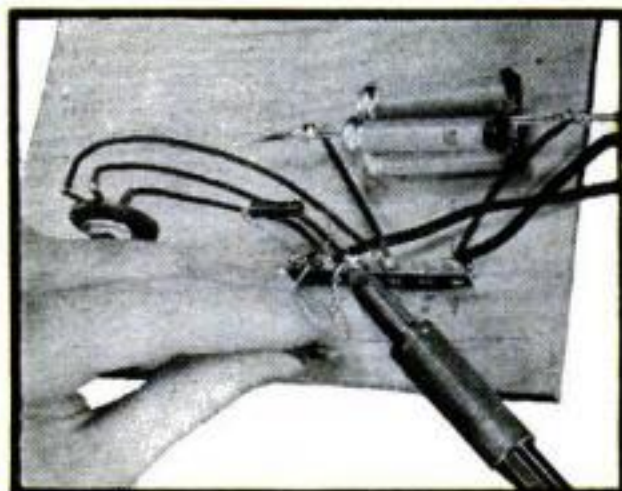
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KNEW NOTHING ABOUT RADIO

"I knew nothing about Radio when I enrolled. At present I am doing spare time work. I have more than paid for my Course and I have about \$200 worth of equipment which has paid for itself." — **RAYMOND HOLT-CAMP**, Vandalia, Illinois.



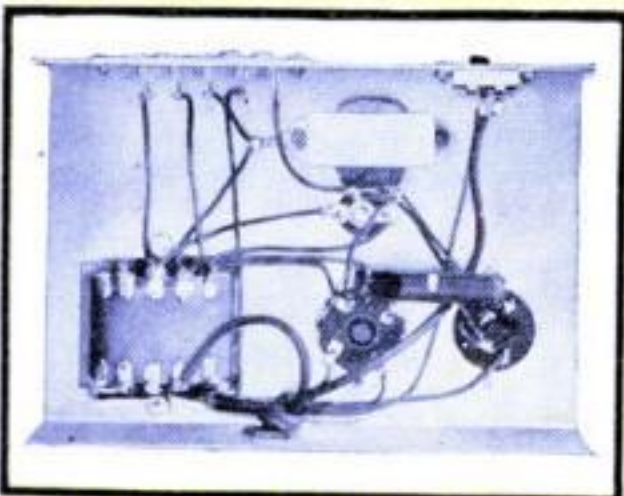
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"After completing about two-thirds of my Course I entered a Radio Repair shop. Later I branched out for myself and opened a shop in my own home. I am much pleased with the work I had during my first year of business." — **A. H. AYERS**, Washington 10, D. C.

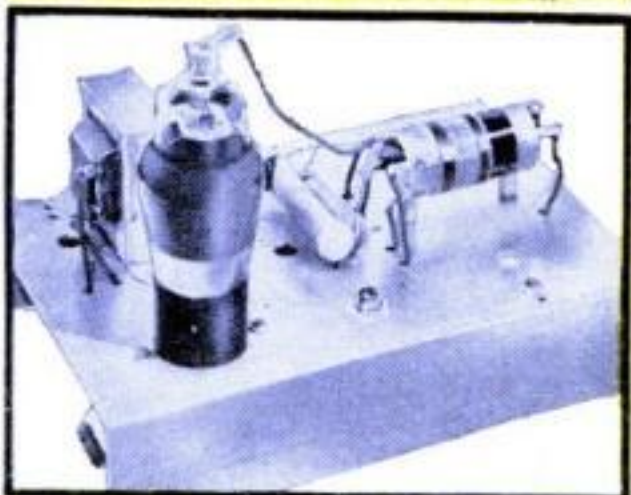


by Practicing in Spare Time

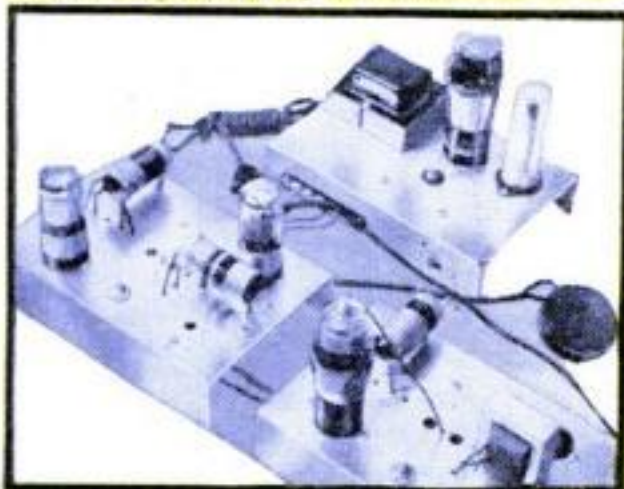
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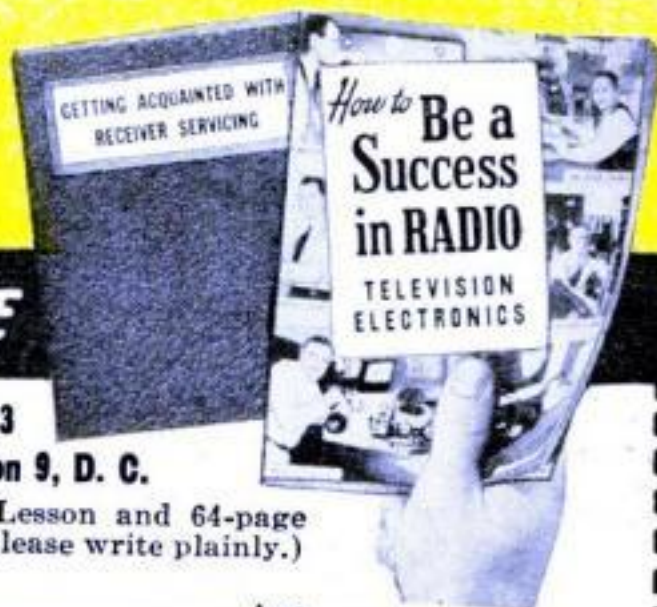
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IF you just like to dream, read no further. There comes a time when your fancies *must be* brought into light—and stand the test of every-day, hard realities. Are you one of the thousands—perhaps millions—whose thoughts never get beyond the stage of *wistful wishing*? Do you often come to from a daydream with the sigh, "If only I could bring it about—*make it real*?"

All things begin with thought—it is what follows that may take your life out of the class of those who hope and dream. Thought energy, like anything else, can be dissipated—or it can be made to produce actual effects. *If you know how to place your thoughts* you can stimulate the creative processes within your mind—through them you can assemble things and conditions of your world into a happy life of accomplishment. *Mental creating* does not depend upon a magical process. It consists of *knowing how* to marshal your thoughts into a power that draws, compels and organizes your experiences into a worth-while design of living.

ACCEPT THIS *Free* BOOK

Let the Rosicrucians tell you how you may accomplish these things. The Rosicrucians (not a religious organization), a world-wide philosophical fraternity, have preserved for centuries the ancients' masterful knowledge of the functioning of the inner mind of man. They have taught men and women how to use this knowledge to *recreate their lives*. They offer you a free copy of the fascinating book, "The Mastery of Life." It tells how you may receive this information for study and use. Use coupon opposite.

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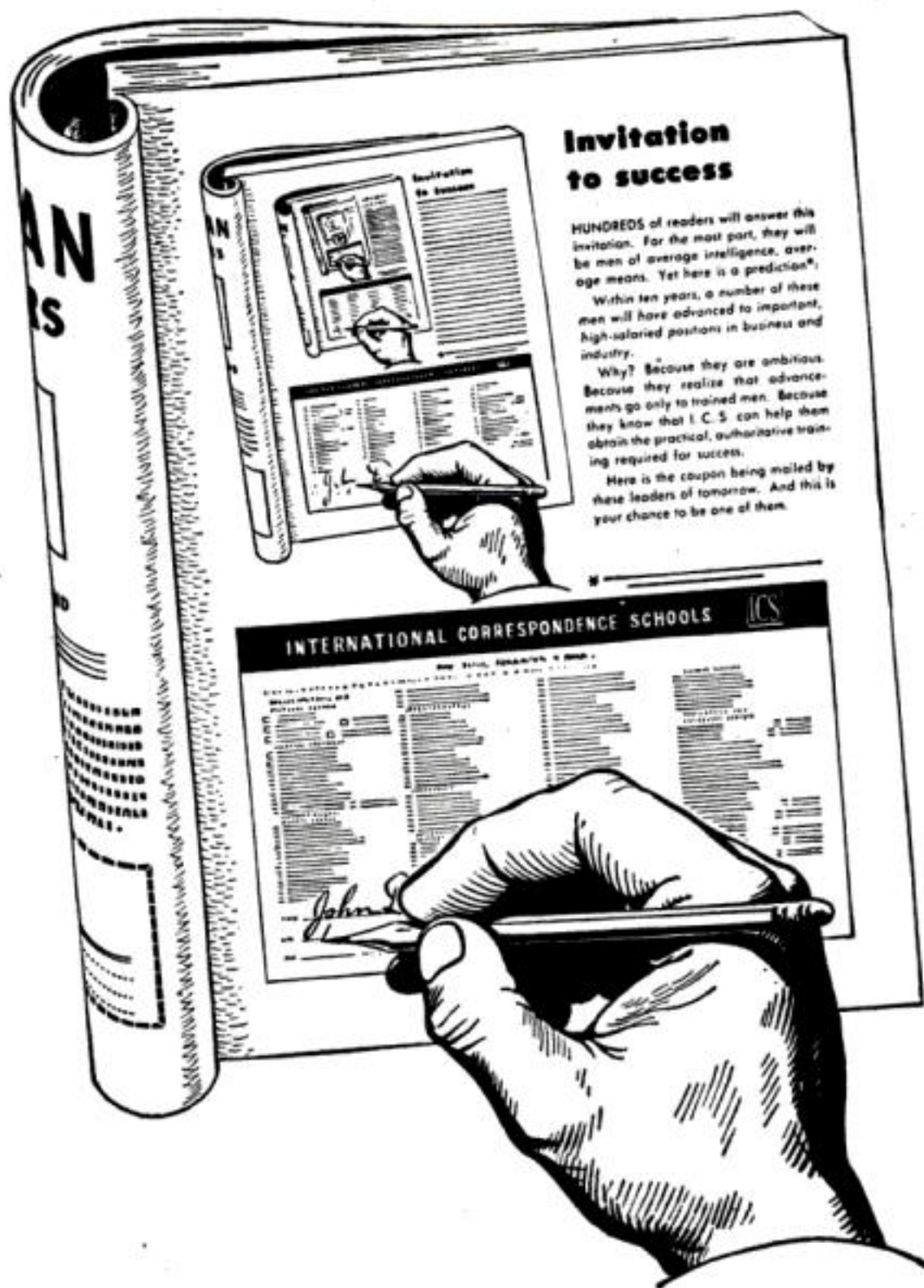
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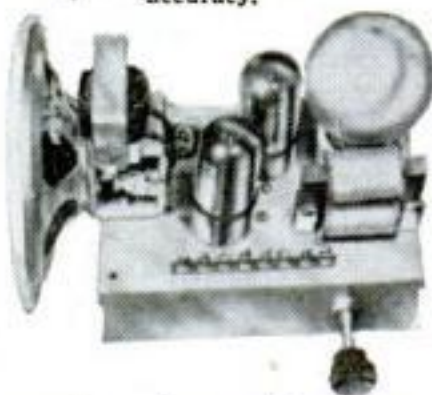
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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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Letters



"Flak Bait"

Sir:

Didn't I read somewhere some time ago that Devon Francis, the POPULAR SCIENCE writer who described his flight in the supersonic jet plane in the September issue, was about to publish a new aviation book? Is it out yet, and where can I buy it?

HOWARD STARZEL

Chicago, Ill.

We've been waiting for someone to ask us about that book. Now maybe we can work off a little of the pride we've been carrying around since it came out in June. Called "Flak Bait," the new book is Associate Editor Francis' first venture into what he calls the romantic aspects of flying, and is the story of twin-engine air bombardment in World War II. Published by Duell, Sloan & Pearce, it contains 64 pages of illustrations and can be purchased at bookstores or by mail from the publisher at 270 Madison Ave., New York 16, N. Y. With Christmas coming, need we mention that the book might solve some of those what-to-get-him shopping problems?

Whooping Engines Up with Water

Sir:

Would you please explain the theory and practice of water injection into an aircraft engine to increase its power and consequently the velocity of an airplane? What is the usual pressure necessary to force the water into the cylinders, and what is the result of continuing the practice of water injection? Could the principle be applied to jet planes?

B. D. BALANAG

San Francisco, Calif.

To answer Mr. Balanag, PS called on Col. C. H. Welch, of the U. S. Air Force, whose reply appears below.

Sir:

When used in the conventional reciprocating engine where considerable supercharging is used, water is injected into the inlet air stream and is used primarily to

INVENTORS

Patent laws encourage the development of inventions.

We recommend that an inventor employ a registered Patent Attorney or agent, if the inventor is not familiar with patent matters. This is because the value of a patent depends largely upon the skillful preparation of the specification and claims in the patent application.

The firm of McMorrow, Berman and Davidson is registered to practice before the United States Patent Office. Additionally it engages patent attorneys able to readily understand inventors' disclosures, to advise concerning patentability, and to prepare appropriate specifications and claims.

If an inventor believes he has an invention, a search of the most pertinent prior U. S. patents should be made and a report obtained relative to its patentability. Where such report indicates that the invention appears patentable, in order to secure protection, diligence should be exercised in making application for a patent.

Send for a copy of Patent Booklet entitled "How To Protect Your Invention." This booklet contains information on patent protection and procedure. You will also receive an "Invention Record" blank. This will be promptly forwarded to you upon request—no obligation.

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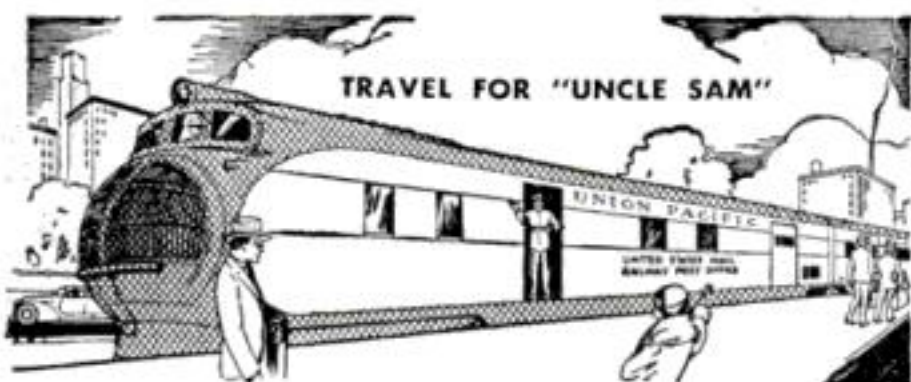
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Railway Postal Clerks

Railway Postal Clerks get \$2,750 the first year regular, being paid on the first and fifteenth of each month. (\$114.60 each pay day.) Their pay is automatically increased yearly to \$3,850. Advance may be had to Chief Clerk at \$5,850 a year. (\$243.75 each pay day.) Male veterans only.

3 Days On—3 Days Off—Full Pay

Railway Postal Clerks on long runs usually work 3 days and have 3 days off duty or in the same proportion. During this off duty their pay continues just as though they were working. They travel on a pass when on business. When they grow old, they are retired with a pension.



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Many other positions are obtainable. Rural Carriers—Stenographers—Typists—Assistant Statistical Clerks—Customs Inspectors—Office Machine Operators—etc. Those wishing these positions should qualify at once.

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reduce the high fuel-mixture temperatures to the cylinder which result from compressing the air or air-fuel charge by means of the supercharger. This cooling results from the high latent heat of the vaporization of the water which is turned to vapor or steam due to the high mixture temperatures produced by the supercharger. This cooling, through reduction of the high mixture temperatures, permits operation of the engine at higher powers due to the reduction of the tendency of the engine to detonate because of high mixture temperatures.

Water injection on this type engine is only beneficial where sufficient supercharging is employed to permit taking advantage of the cooling properties of the water and where the engine is operated at powers close to the detonation limit of the fuels used.

On this type engine, water is usually metered into the intake manifold at pressures equal to that employed in the carburetor and will vary, depending upon the type of engine and point of injection.

Ordinarily whenever the reciprocating-type engine must use fuel in excess of that required for maximum economy operation to provide rich mixtures to escape destructive detonation, the excess fuel performs a cooling function, and equivalent amounts of water can usually be substituted.

With respect to the question concerning the practice of continued use of water injection, no adverse troubles have been encountered from this practice, although ordinarily water injection is only required for take-off or combat powers.

The use of water may be applied to turbojet engines, in which case the water acts to reduce the compressor outlet temperatures, permitting the burning of more fuel without exceeding the critical turbine inlet temperatures and, in addition, adding to the mass flow of gases to the turbojet engine.

COL. C. H. WELCH, USAF
Public Information Officer

Headquarters, Air Materiel Command
Wright-Patterson Air Force Base
Dayton, Ohio

Battle of the Abacuses

Sir:

The abacus article in the August, 1948, issue of POPULAR SCIENCE was more than entertaining; it helped me bear out an old

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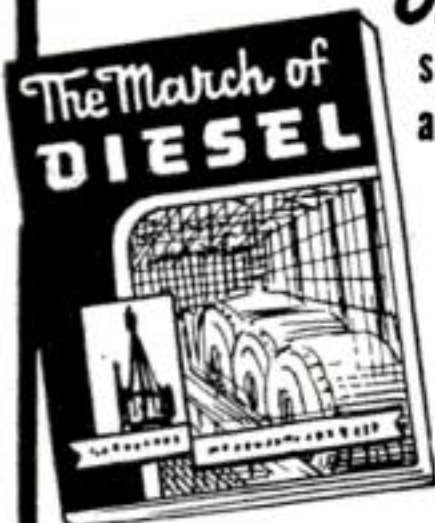
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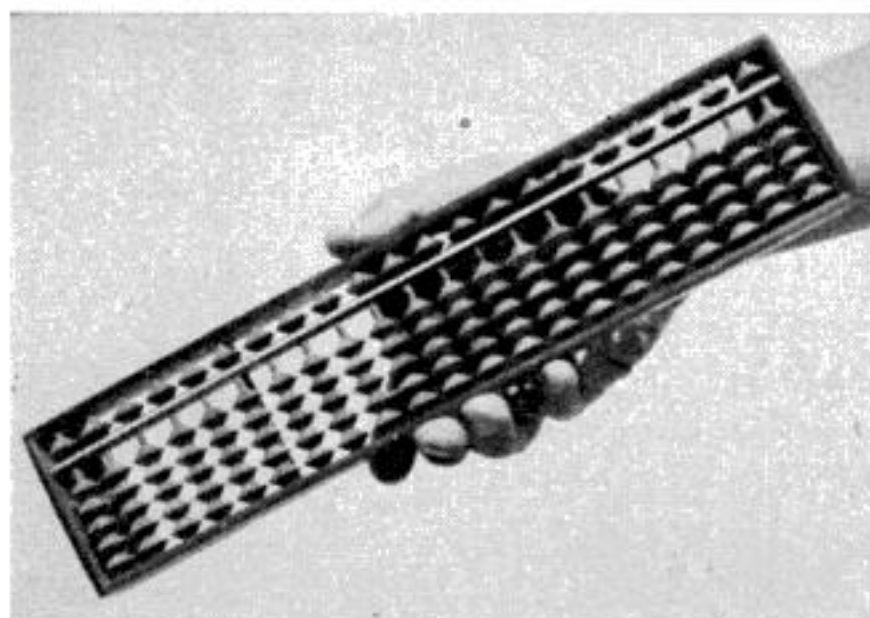
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resolution to collect only those souvenirs,
while overseas, which might be useful.

The Japanese abacus which I liberated
while stationed with a Fifth Air Force unit
at Showa, Japan, had me stumped, but now
I can buzz through my addin', subtractin',
and goesintos with it. One thing still
bothers me. Mr. Loy's abacus has 11 rows
of beads, while the Jap model [shown
below] has 21. How do you make use of



all those extra beads? I hate to see them go
to waste! Also, are the little black dots on
the dividing bar of any significance?

I'd really appreciate hearing the answers
to these questions. Perhaps your abacus
department can produce them.

JACK WILSON

San Pedro, Calif.

*Our abacus department—although some-
what understaffed at the moment—reports
that the 21 rows of beads in the Japanese
model permit more complicated figuring
than does Mr. Loy's simplified version.
However, many Chinese abacuses also have
21 rows, and Mr. Loy himself is soon bring-
ing out such a model, designed for engineer-
ing work, that will do practically everything,
even square root. The black dots are for
convenience in handling large numbers.
They correspond to the comma we use to
separate our larger figures. Incidentally,
the Jap model, although as versatile as the
Chinese, is more difficult to use, Mr. Loy
believes, since it has only one row of beads
above the dividing bar instead of two.*

Why They Hand-Spin Props

Sir:

In your October issue, page 116, in "Prop
Gets Dry Run," the statement is made that
"The manual turning (of the propeller) is

INVENTORS

Unless an inventor is thoroughly familiar with such matters, he is advised to employ a competent registered patent attorney or agent as the value of patents depends largely upon the skillful preparation of the specification and claims.

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selects to assist him. The disclosure should be accompanied by a letter authorizing the patent attorney or agent to conduct a preliminary search among previously granted U. S. patents for similar types of invention. The patent attorney or agent then prepares a report of the probable patentability of the invention and recommends the further course the inventor should take, provided the report indicates possible patentability.

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routine to clear out engines prior to starting and to make sure there is no hydraulic block in the *feathering mechanism*."

As I was a Flight Engineer in the RCAF, when one of my duties was to carry out this procedure, I would like to point out that the manual turning is done not to check the feathering mechanism, which is done *after* the engines are started, at which time the props are "run through" from fine to coarse pitch several times, but to make sure there is no hydraulic block in the lower *inverted* cylinders of a radial or inverted in-line engine. The crankcase oil tends to seep into the combustion chambers of these cylinders, and as oil will not compress, serious damage would result if the engines were started; thus the manual turning. At least that is the explanation we were given.

G. H. LEGGE

Galt, Ontario

Mr. Legge and the RCAF are absolutely right. PS stands corrected.

Model Racers Set New Records

Sir:

In your October issue of PS you have a very interesting feature on Model Racers setting a 128-m.p.h. record. You, I believe, are a little behind in your record. It is now over 135 m.p.h.

Here in Clarksburg, W. Va., we have a Thimble Drone Race Track at the Benedium Airport, where we held a sanctioned race Sept. 19th. We set records in the classification of Gear Driven Cars. A record was established of 80 m.p.h.

We are to have another race soon and we'll break that record. It's the only Thimble Drone track in the United States.

JOHN REEVES

Clarksburg, W. Va.

Doing It the Hard Way

Sir:

In your "I. Q." column (p. 197, Sept., 1948), that trap door looks very silly. Tell Mr. Chi that a piece of screen, chicken wire, or fencing would work better and keep the dogs in or out when it rains.

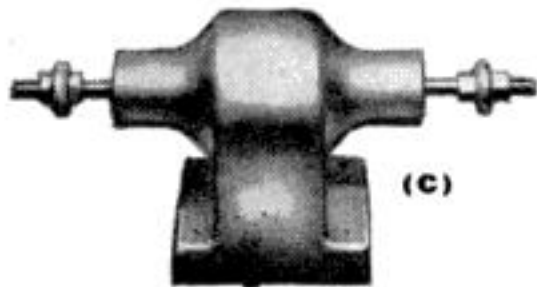
WILLIAM E. WHITE

Princeton, Fla.

Mr. Chi undoubtedly thought of this, but sometimes the hard way is more fun.



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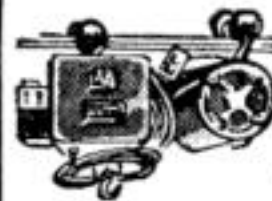
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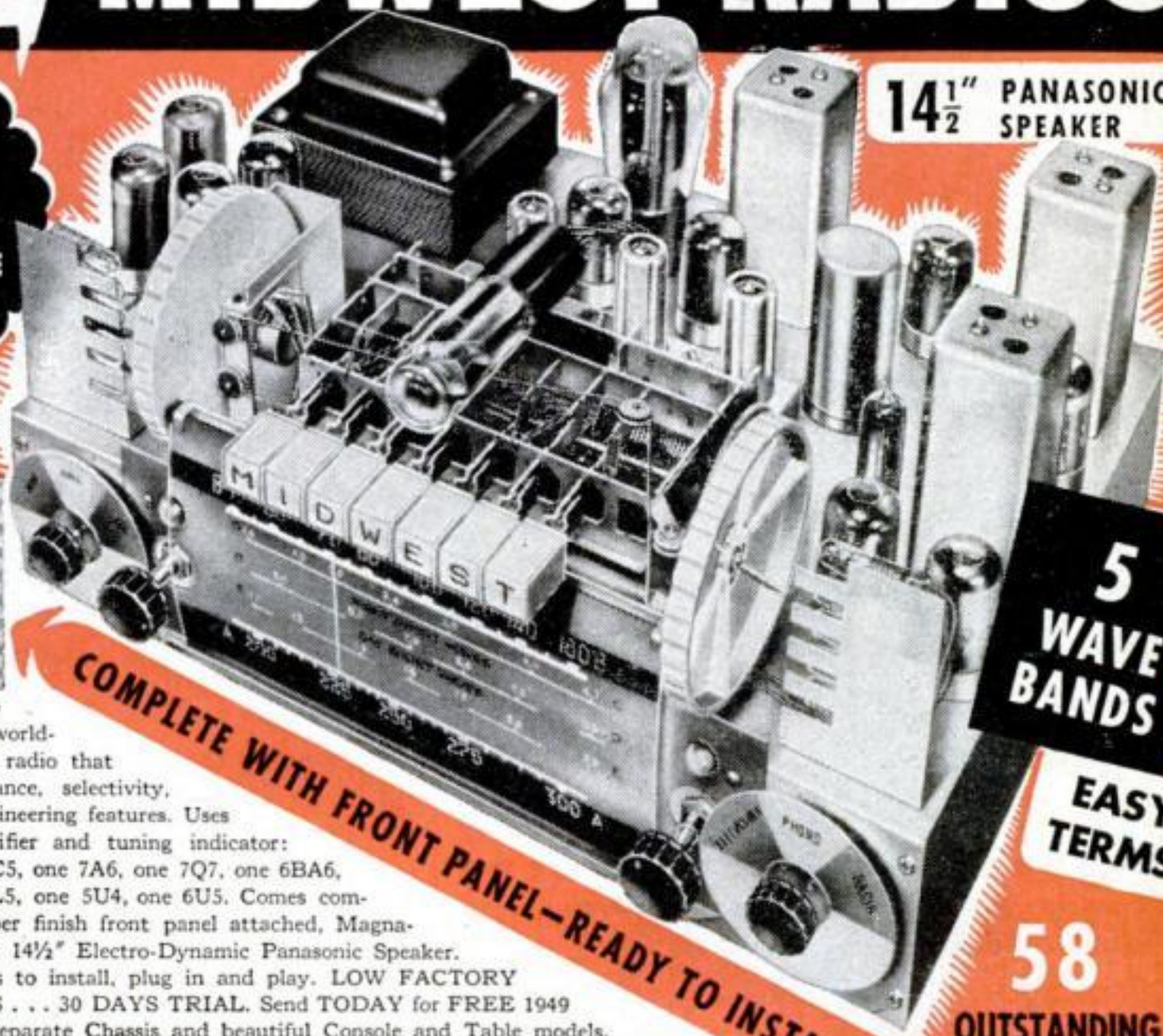
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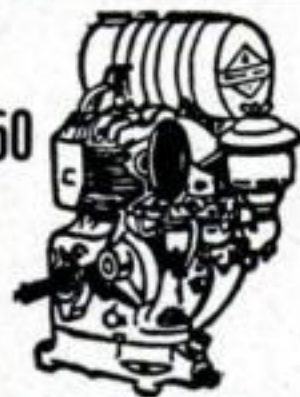
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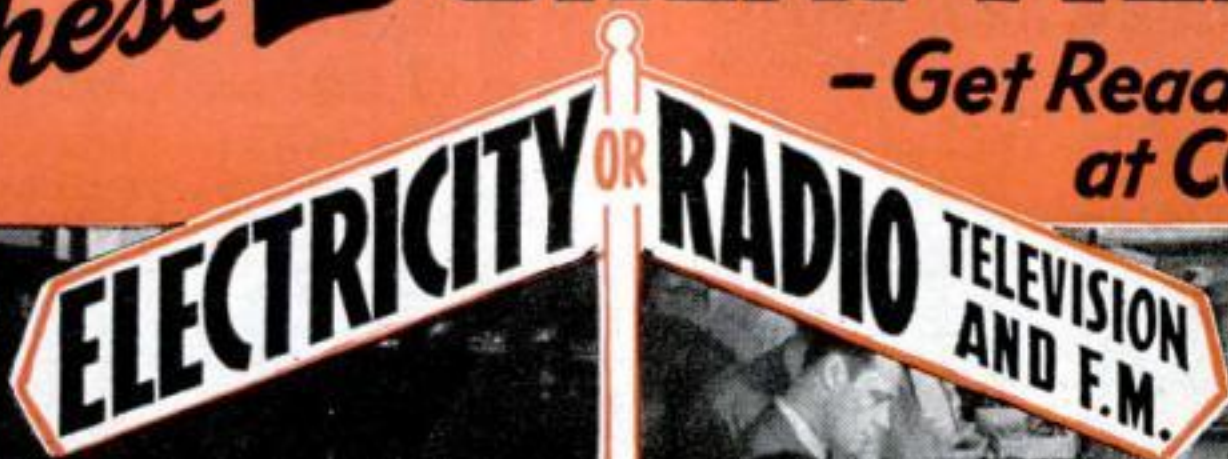
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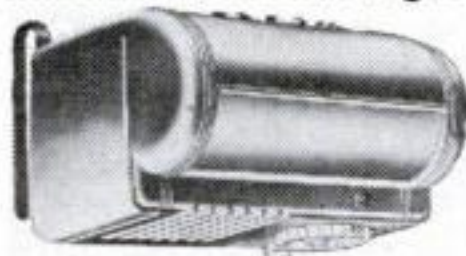
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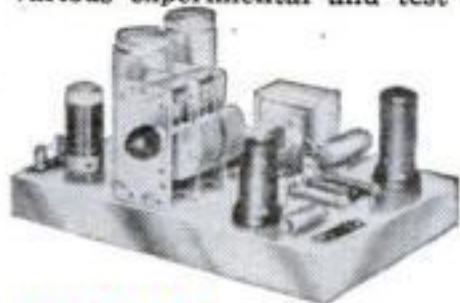
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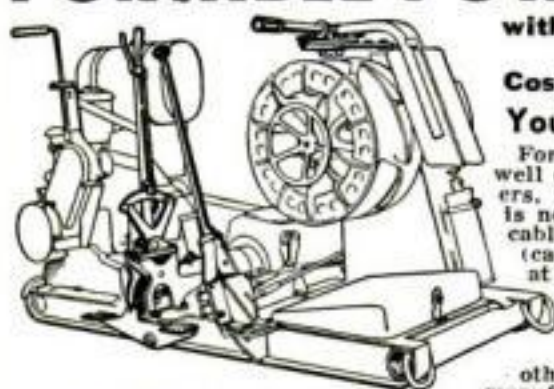
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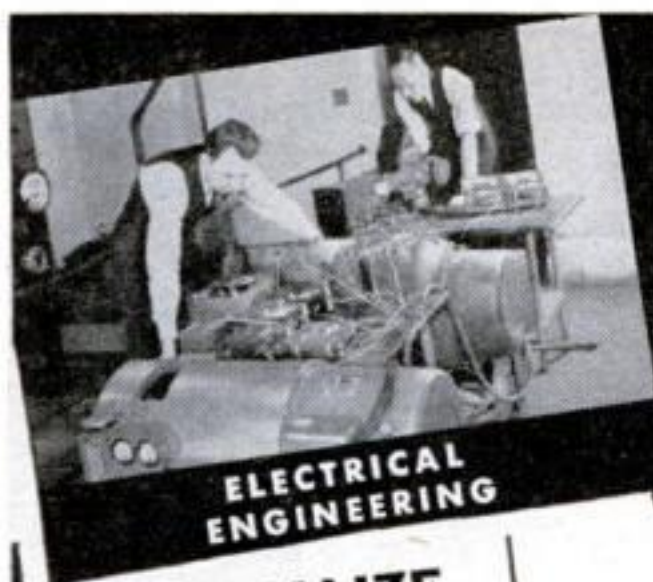
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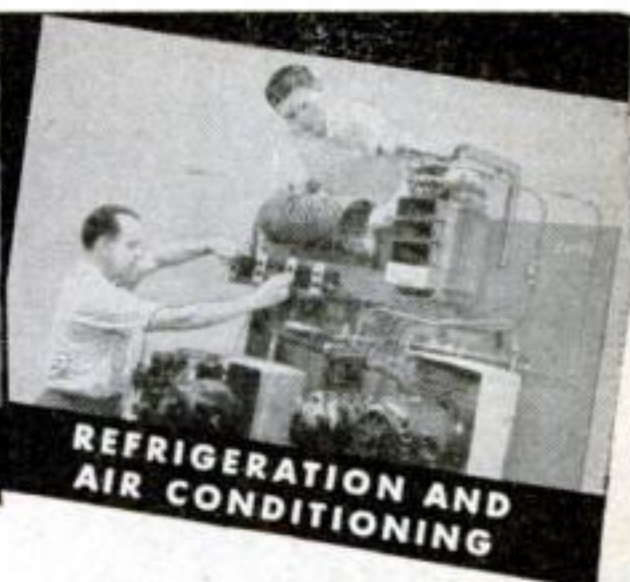




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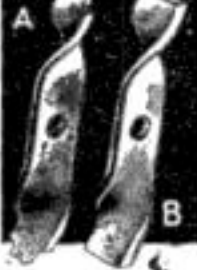


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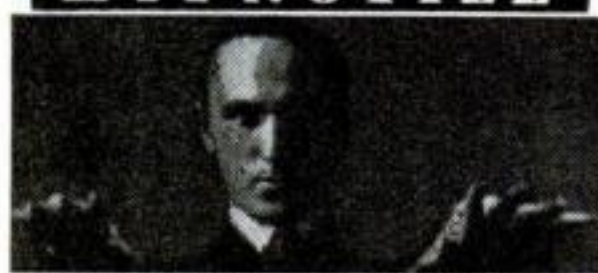


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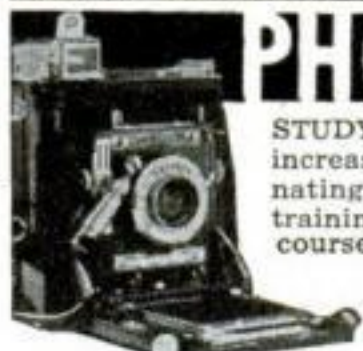
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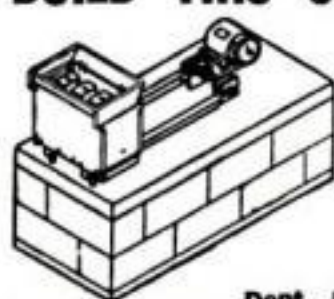
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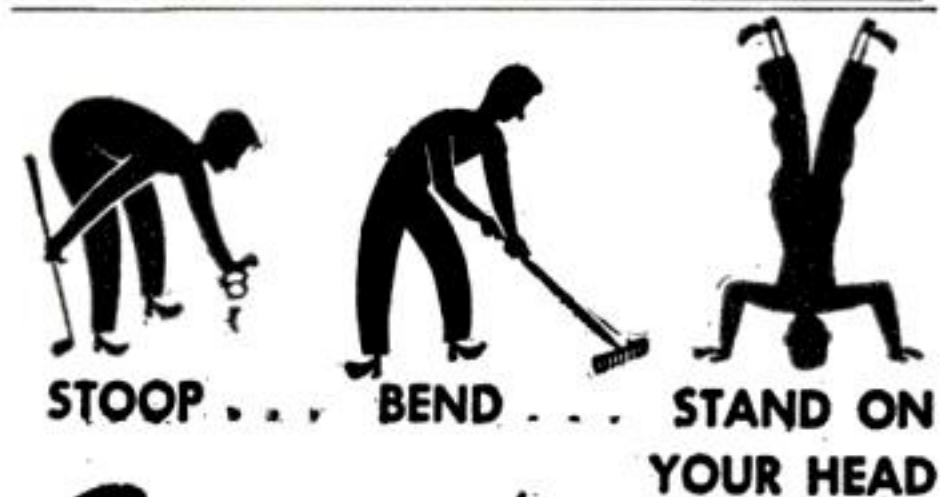
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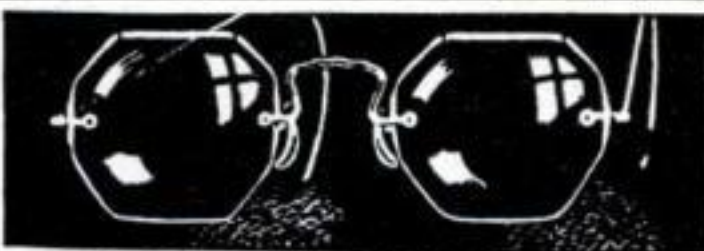
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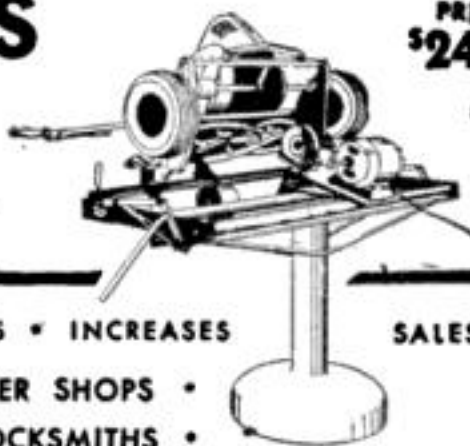
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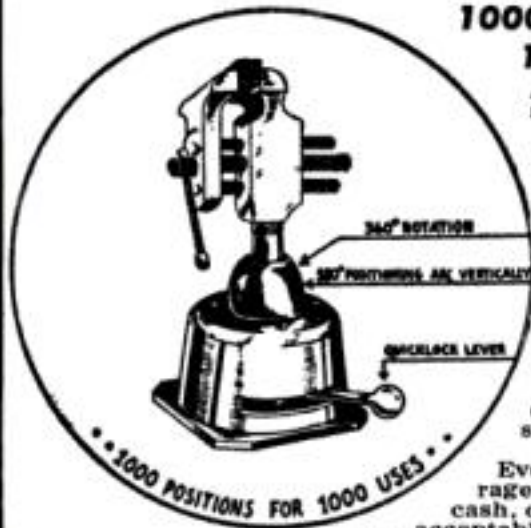
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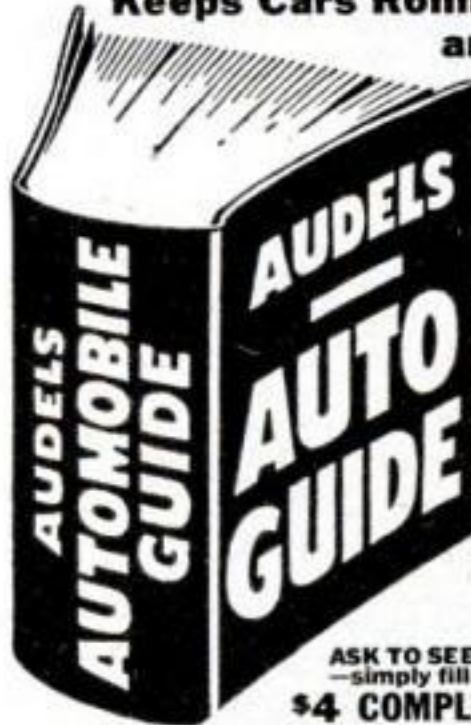
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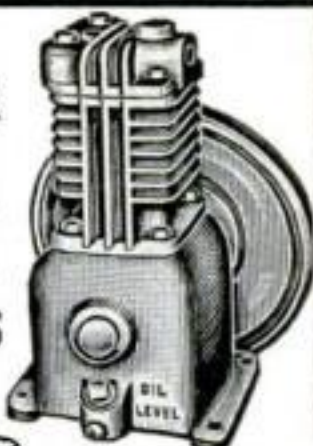
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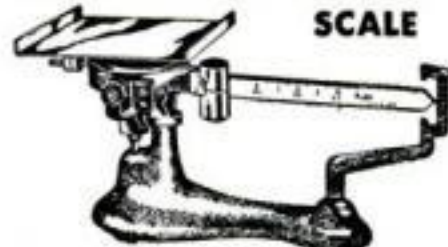


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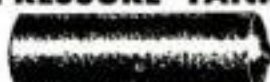


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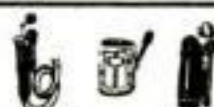


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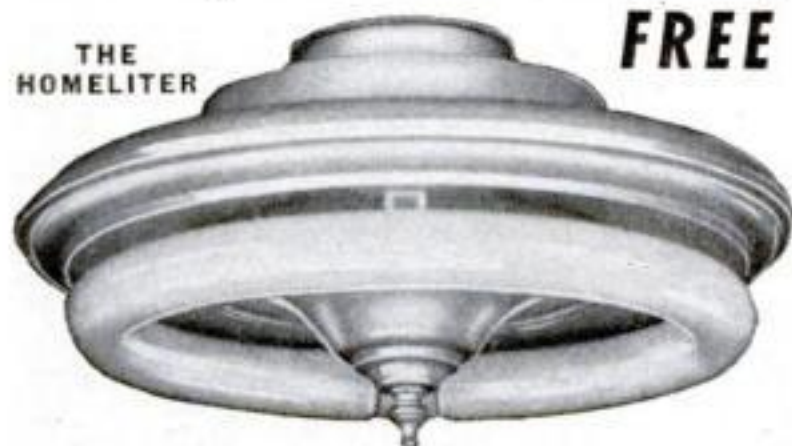
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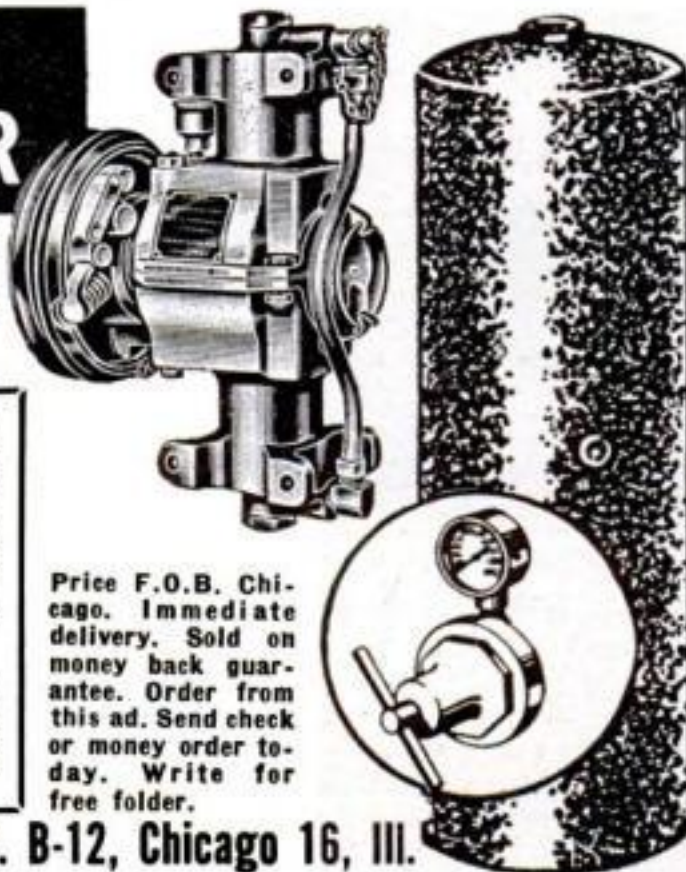
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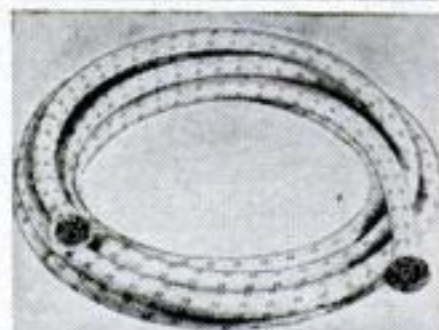
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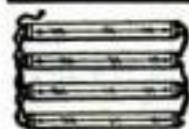


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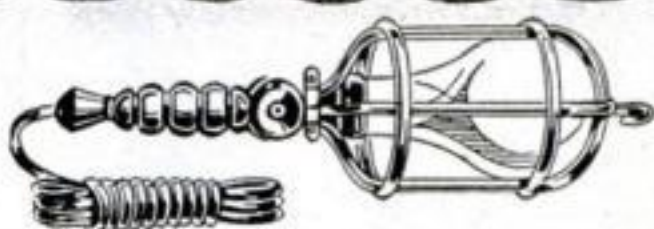
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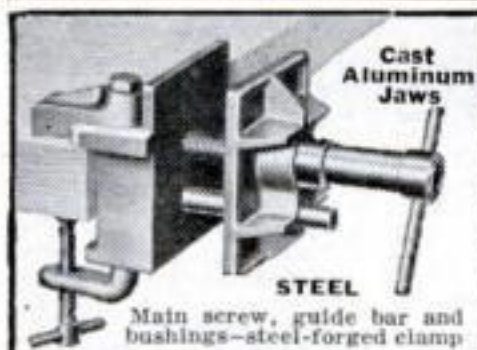
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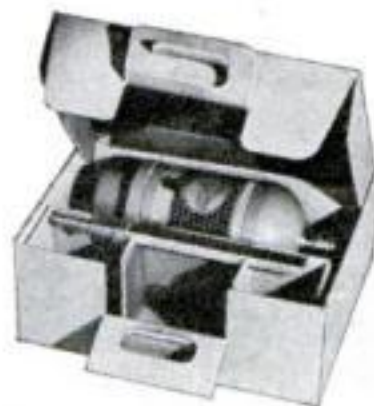
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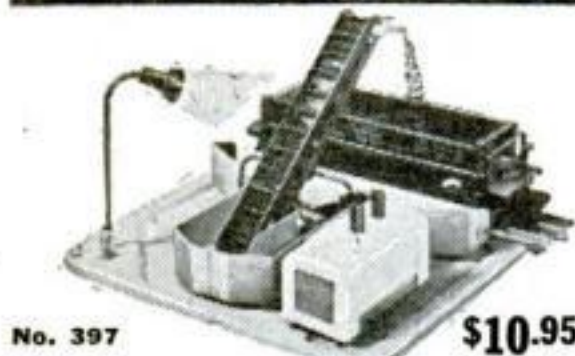
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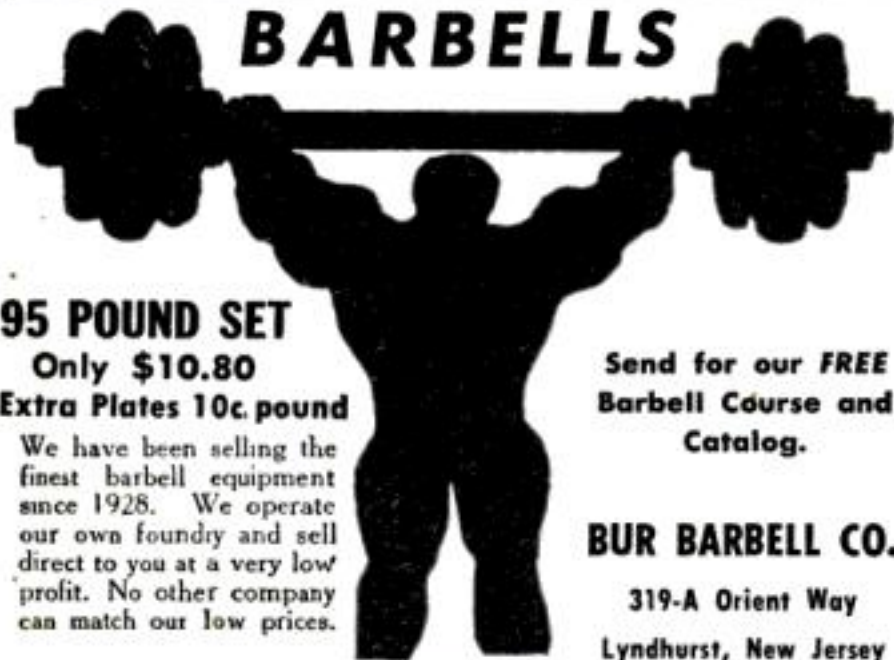
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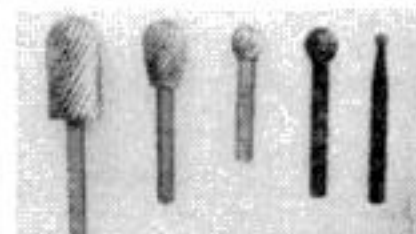
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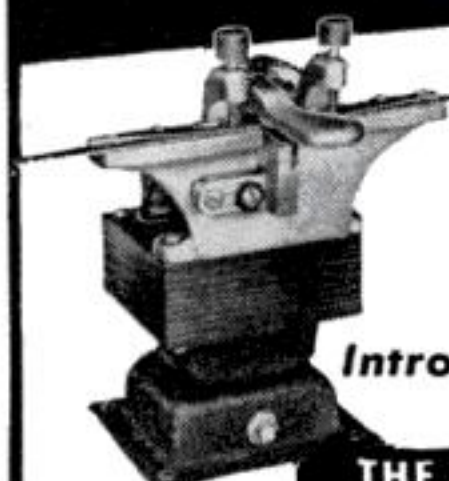
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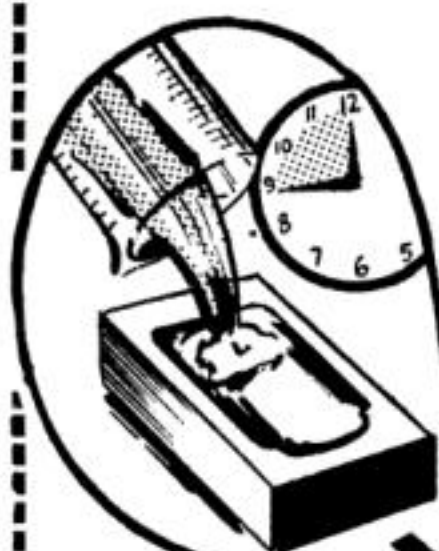
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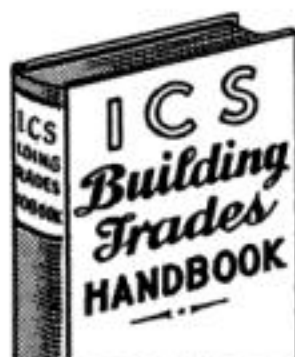
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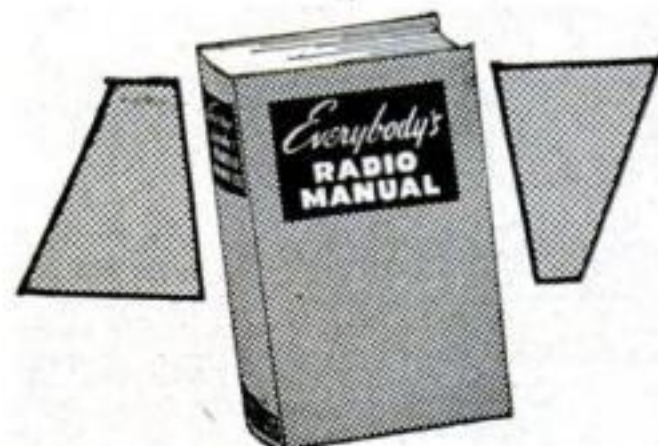
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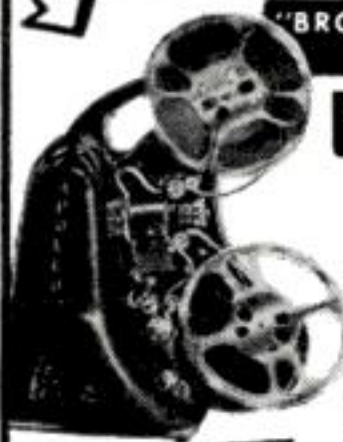


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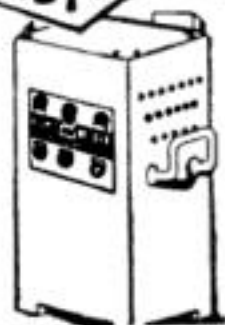
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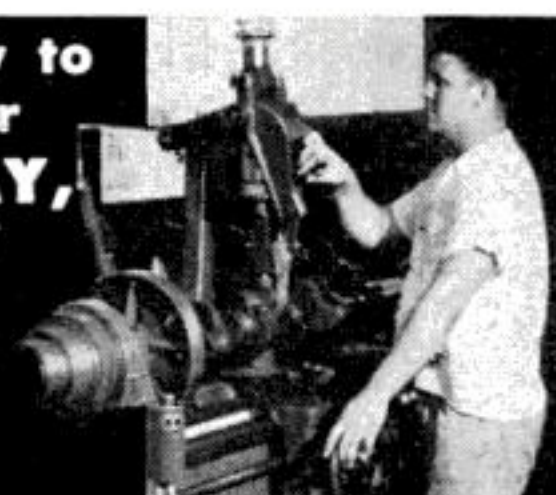
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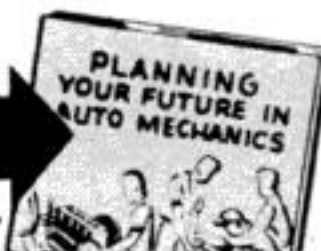
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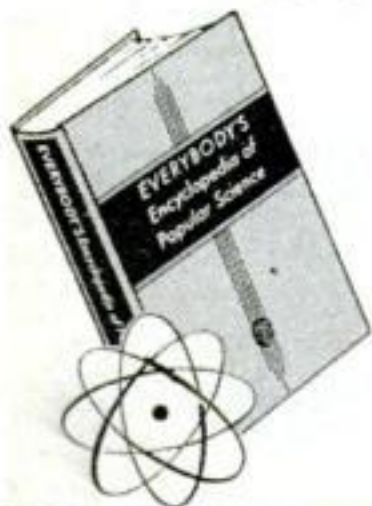
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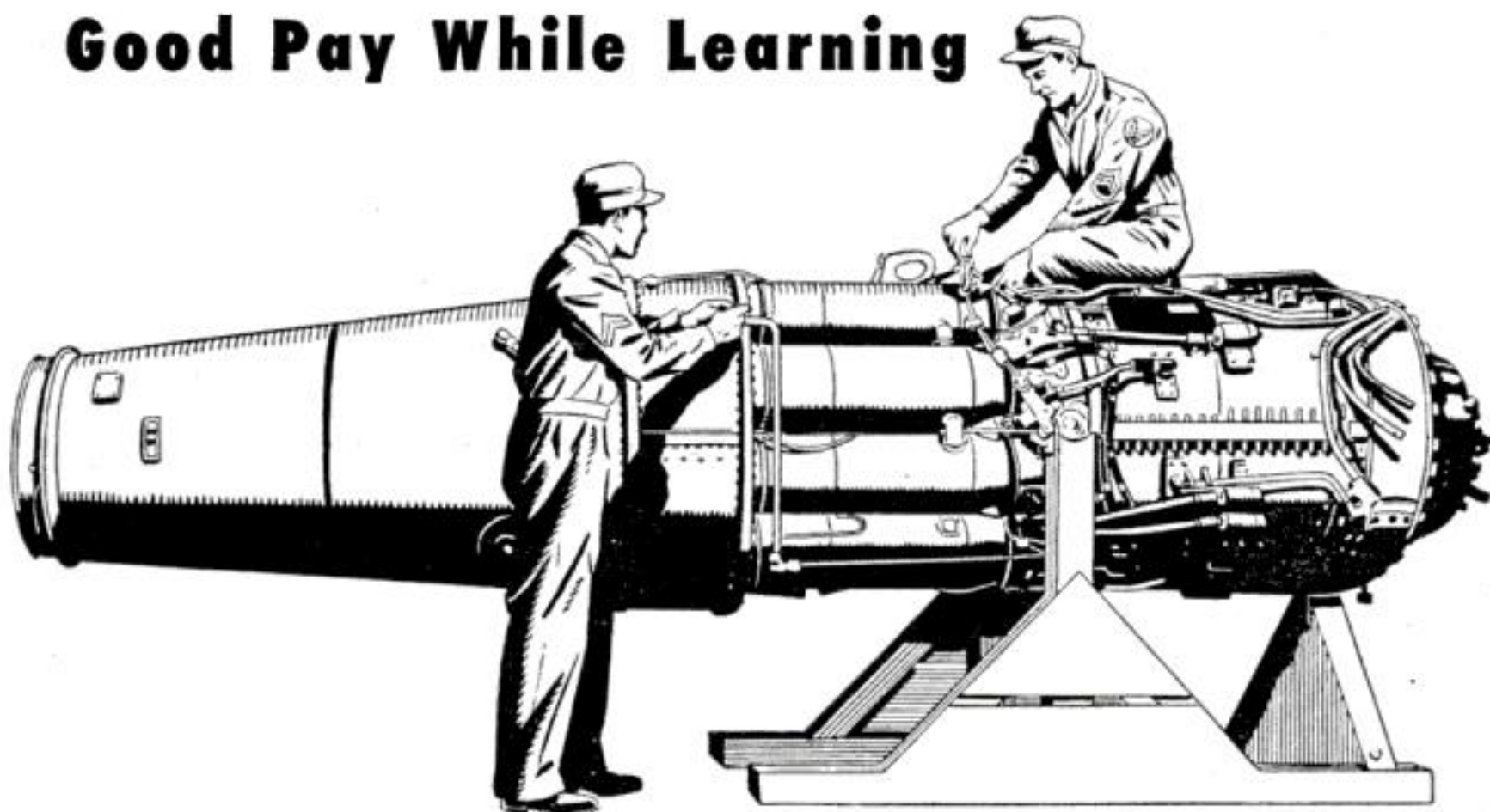
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61 HELP WANTED

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R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

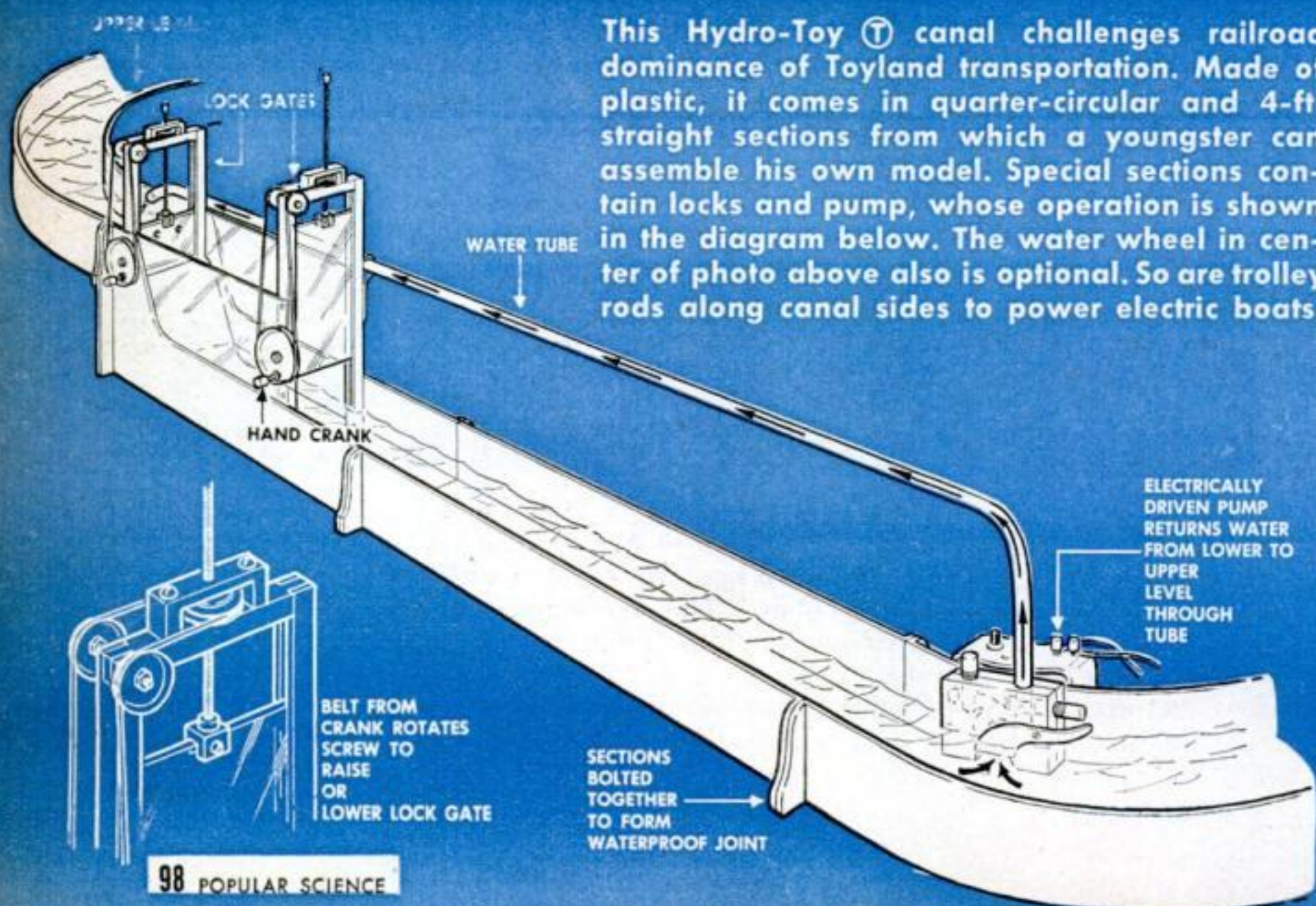
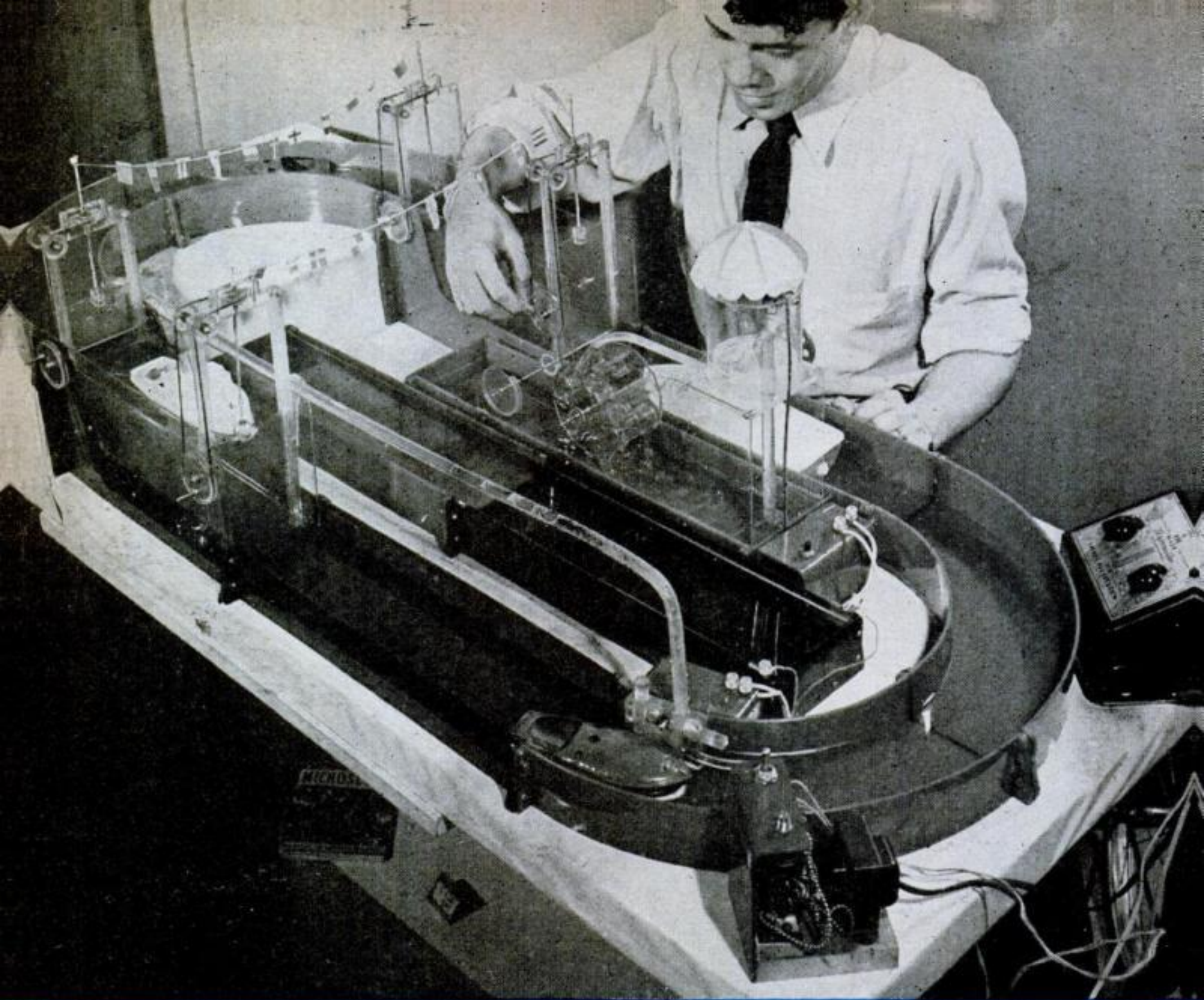
Prince Albert

Smoking Tobacco

THE NATIONAL JOY SMOKE



Magic Carpet?... Fourteen feet up in space, sound engineer F. K. Harvey tries out a new wire-mesh floor for Bell Telephone's famed super-soundproof "Dead Room." The floor is needed to hold tons of test instruments in the geometric center of the room, but it must not interfere with the delicate tests by reflecting sound waves itself. Here, however, sound patterns set up by waves radiating from the large horn on the left to the small one on the right show that the floor reflects almost no sound at all.



This Hydro-Toy ① canal challenges railroad dominance of Toyland transportation. Made of plastic, it comes in quarter-circular and 4-ft. straight sections from which a youngster can assemble his own model. Special sections contain locks and pump, whose operation is shown in the diagram below. The water wheel in center of photo above also is optional. So are trolley rods along canal sides to power electric boats.



Cover by Ray Quigley

How the New Toys Work

If father wants to be ready for the children's Christmas questions, he had better start doing his homework now.

By Hartley E. Howe

CHRISTMAS Day you're safe. Between the excitement and the turkey and all the new things, the children haven't much time to give you the treatment.

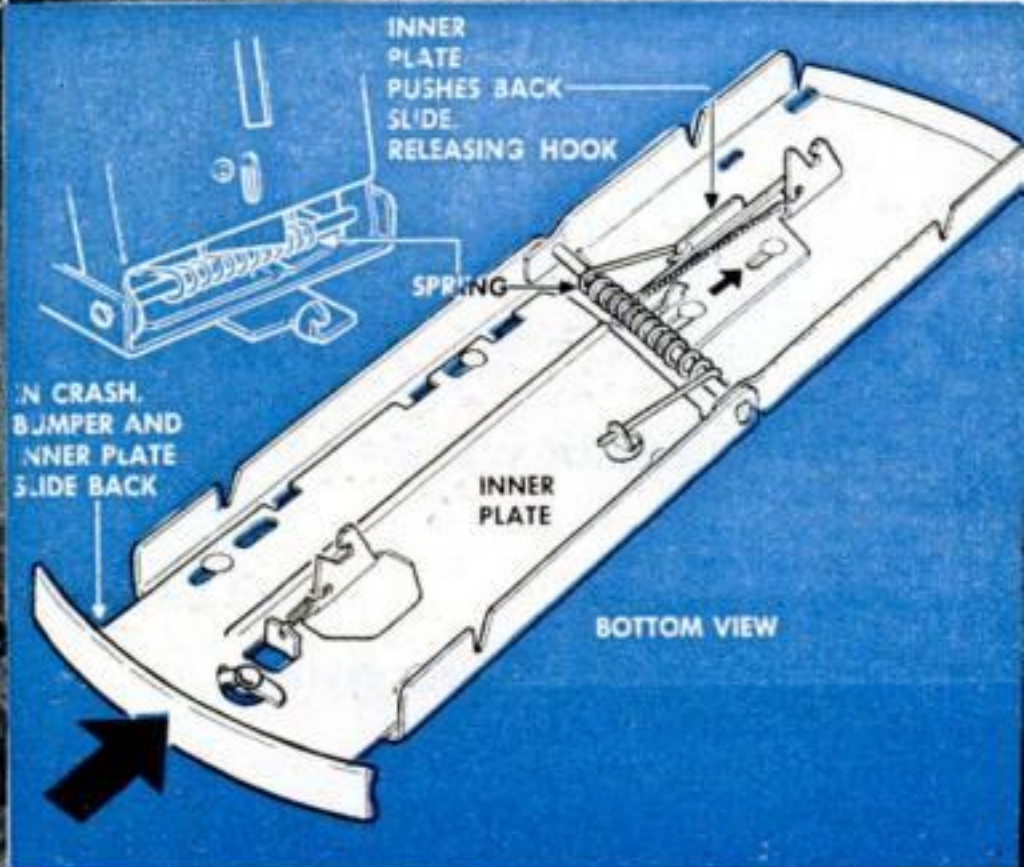
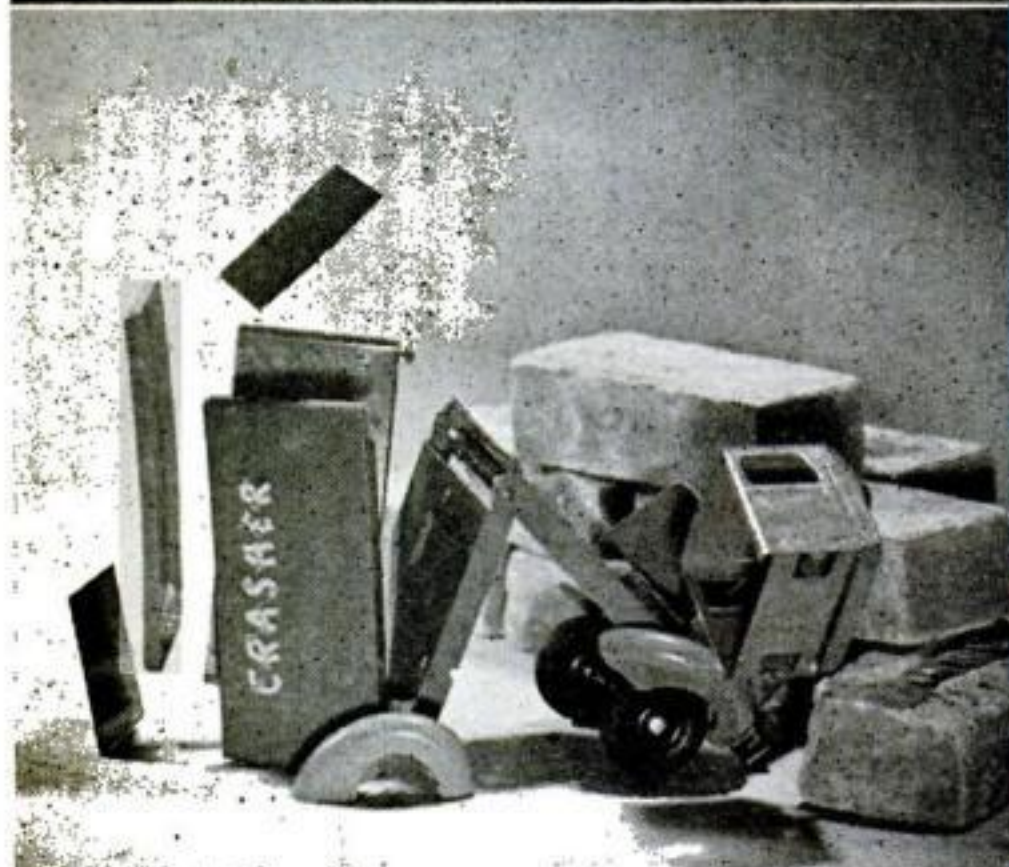
But the day after Christmas—get down the Encyclopedia Britannica, haul out your old physics book, look up the number of the Public Library reference service—and prepare for the worst. Young America wants to know—and they want you to tell 'em. How does a doll cry? Why does the diver sink? “Gee, Pop, what makes my truck pick things up? Is it 'lectricity, Pop? Huh?”

Those are just samples. Simple ones, too. For if you have any idea that it's easy to explain how a toy works, just take a look at the ones that are going to turn up under the trees this year. With postwar material shortages largely past, the full scope of Yankee industrial ingenuity has been turned to amusing American youngsters—and baffling their fathers.

That's why POPULAR SCIENCE has come to your rescue with the inside dope on how some of the trickiest of the new toys really work. It wasn't an easy story to do. The toy business is almost as competitive as the automobile business, and the toy makers are pretty cagey about letting out any of their trade secrets ahead of time. We were

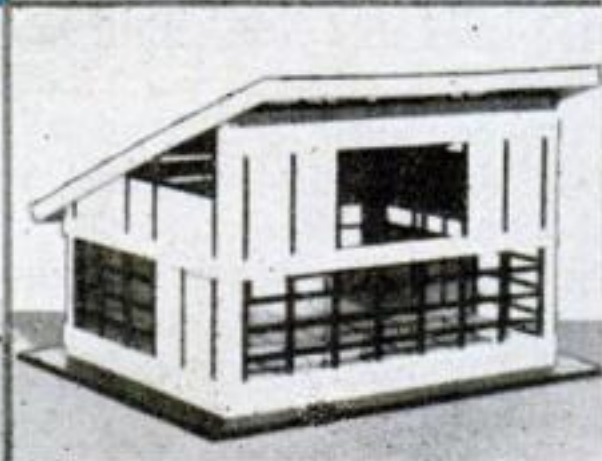
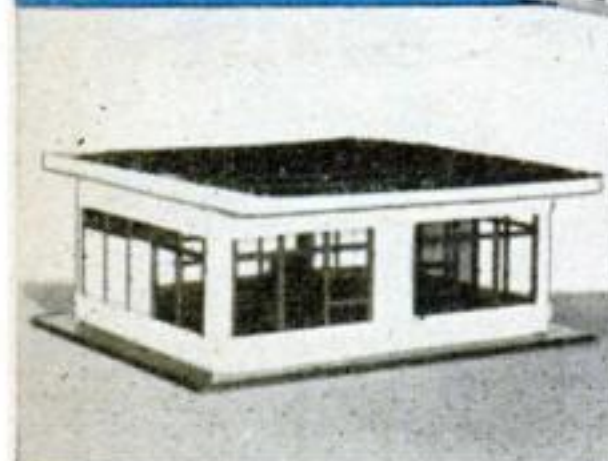
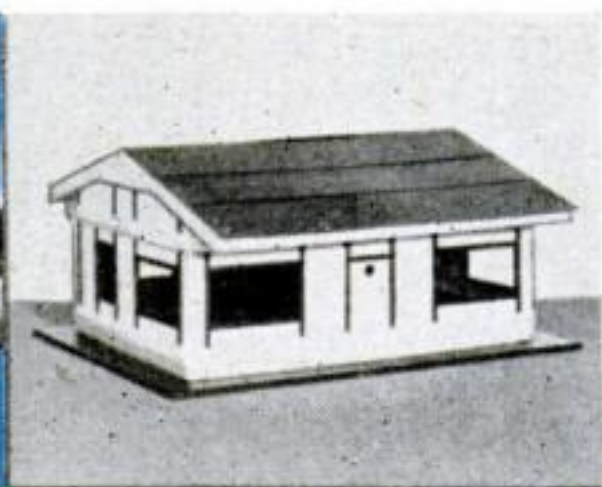


Submerged in a tank, this plastic diver rises to the surface of the water when the bulb at the end of the hose is squeezed. Air, forced into the hollow body, makes the diver lighter than the water, and thus it rises. The toy is made by the Plastine Mfg. Co., of New York.



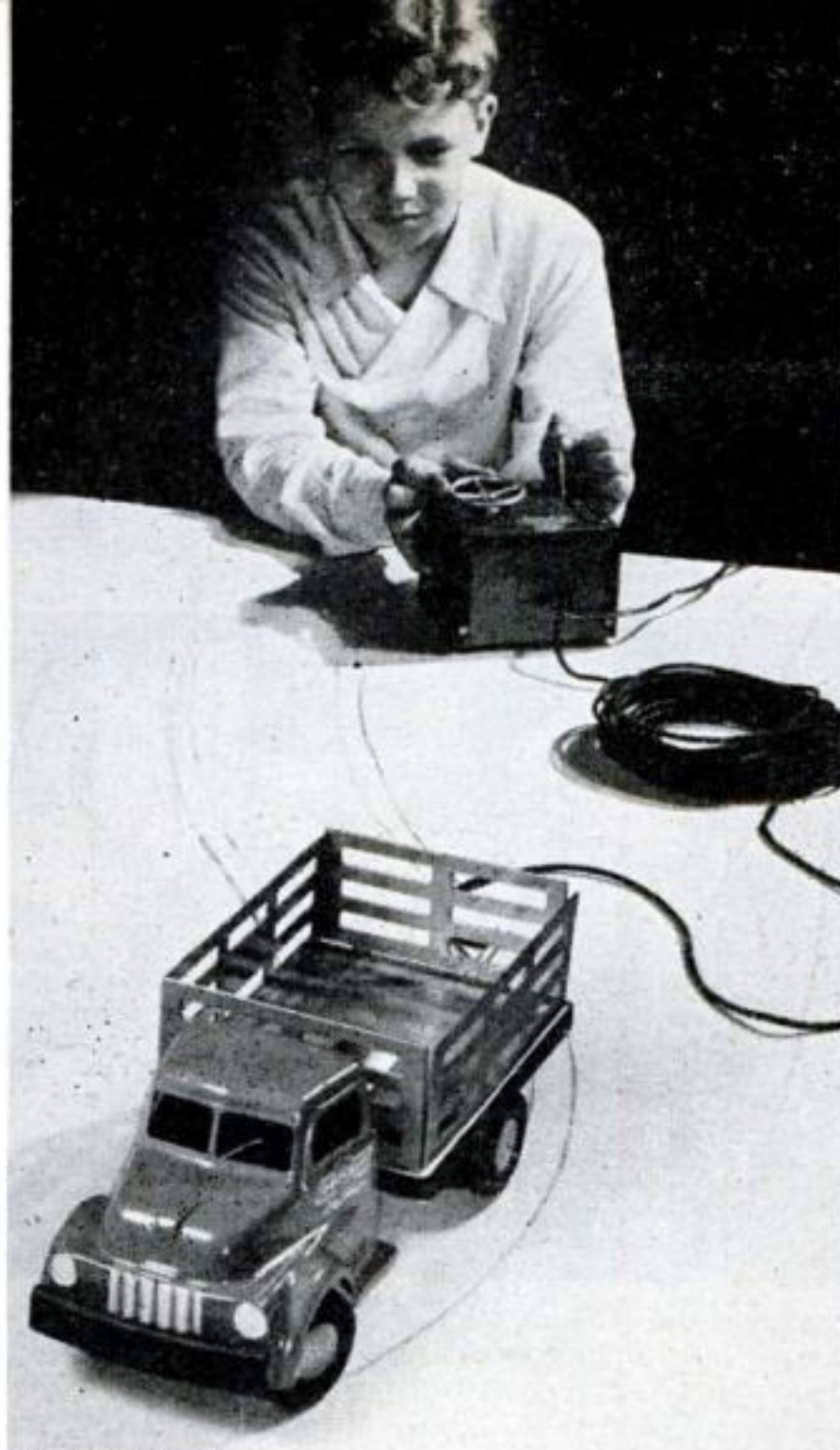
When this metal truck smashes into a wall, it flies into pieces. The secret is a strong spring, like a mousetrap's, inside. Its catch, held by a flat plate under the chassis, is released when

the front bumper hits and knocks back the plate. The spring collapses the hinged bottom of truck, and the top and sides shoot off. The Tropa Industrial Corp. makes the Crasher.

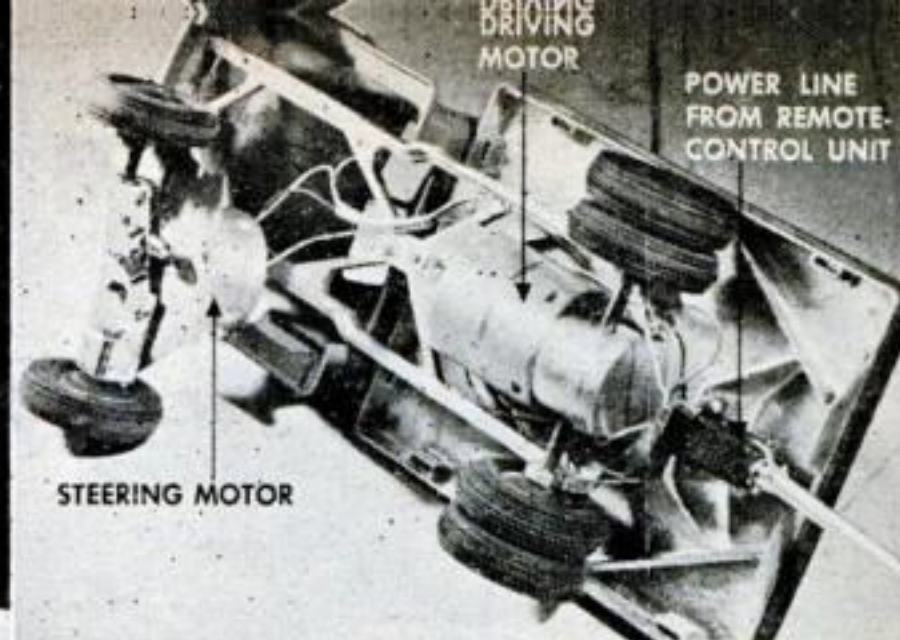


This miniature prefabricated house is put together with nuts and bolts. Scaled $\frac{1}{4}$ inch to the foot, the plastic panels are the equivalent of 4 by 8 feet. Special ones hold various doors

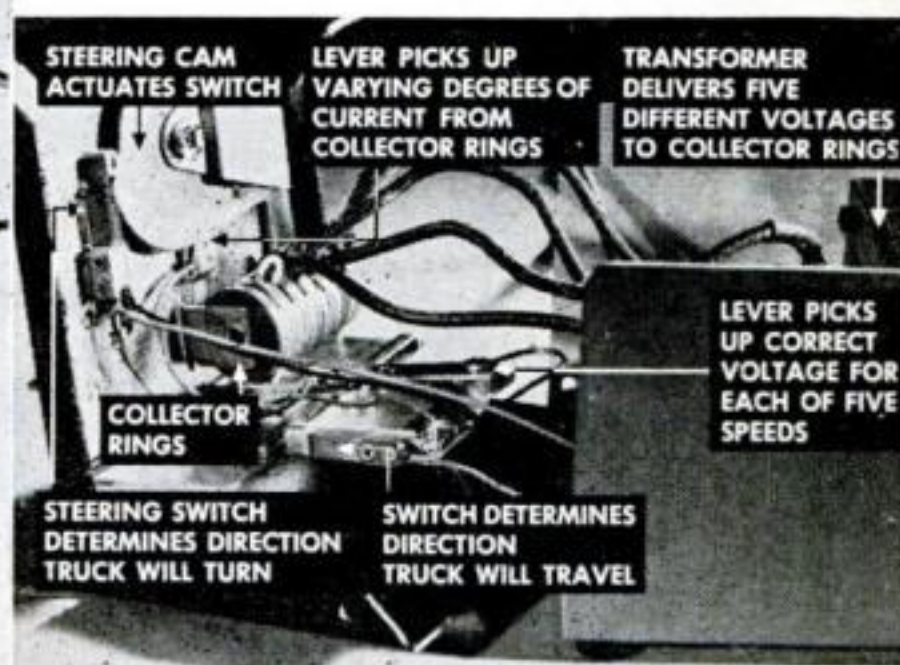
and windows. All panels slip into grooved channels, formed of strips bolted together along the top and bottom of each wall. The Prefab Toy Corp., of New York, is the manufacturer.



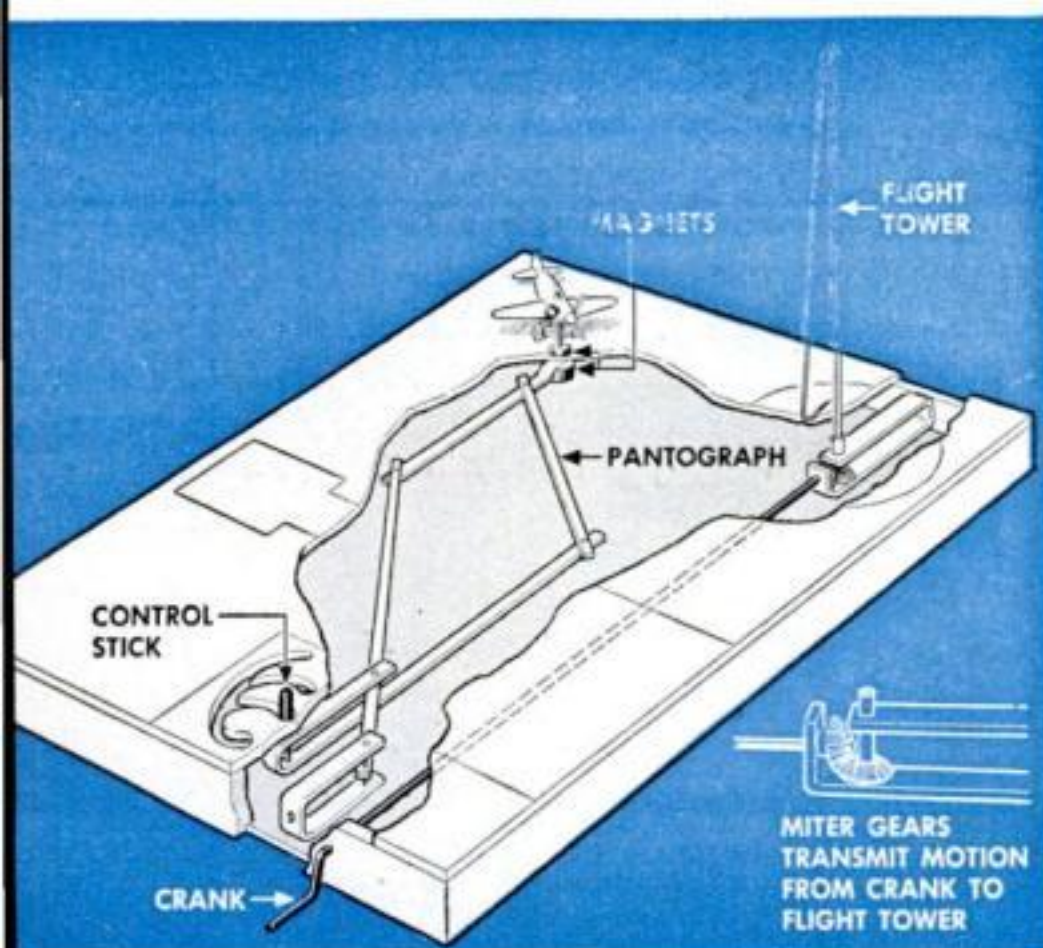
This Dri-Vit truck can be steered, speeded and slowed, reversed, and stopped—all by remote control through cord from transformer. It is made by L. N. Schwien Engineering Co.



Underside of truck shows two motors—one to steer, one to drive it. Speed of steering motor determines how far it turns front wheels; speed of driving motor, how fast truck goes.



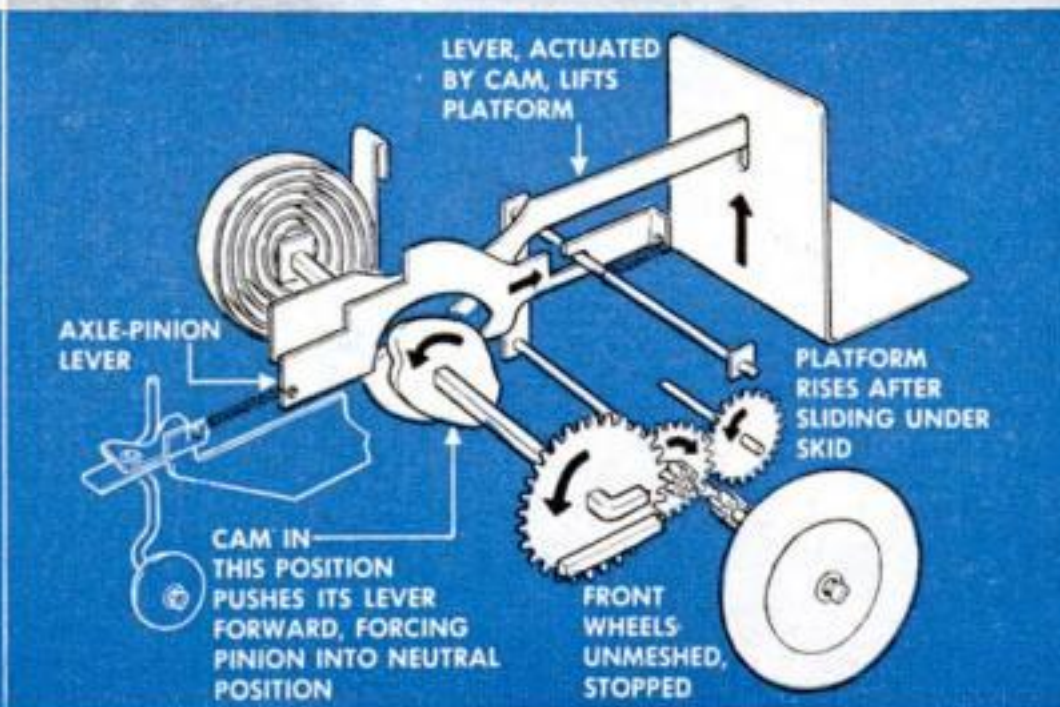
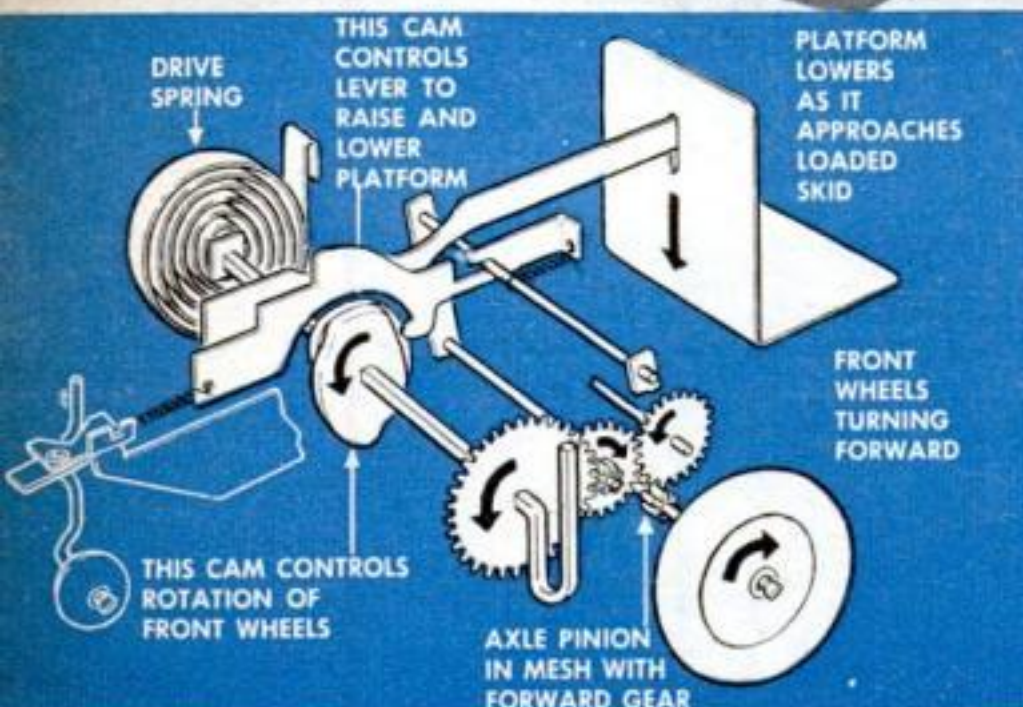
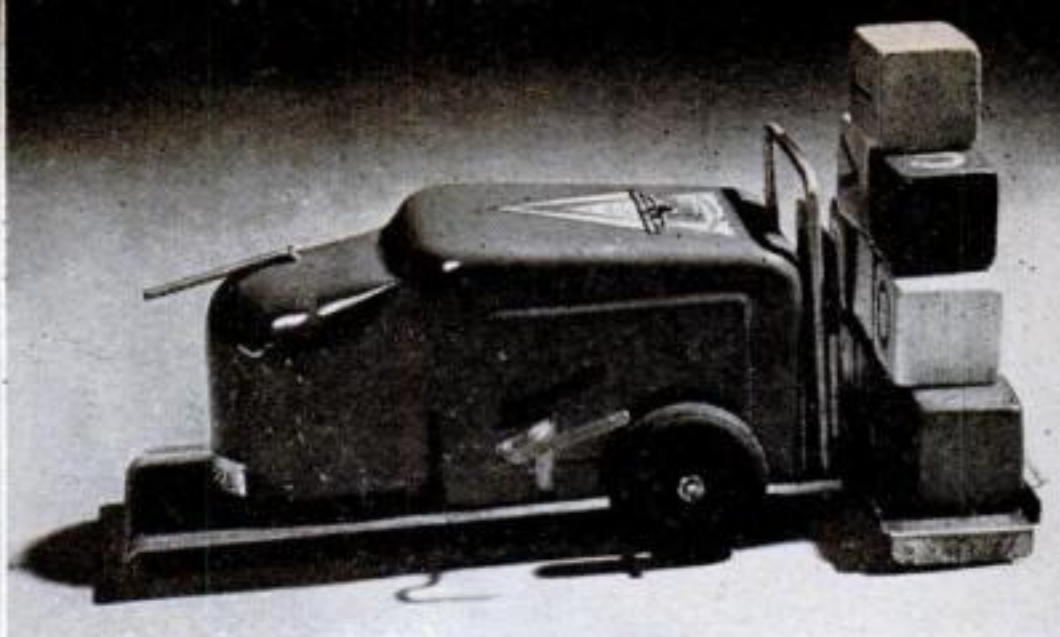
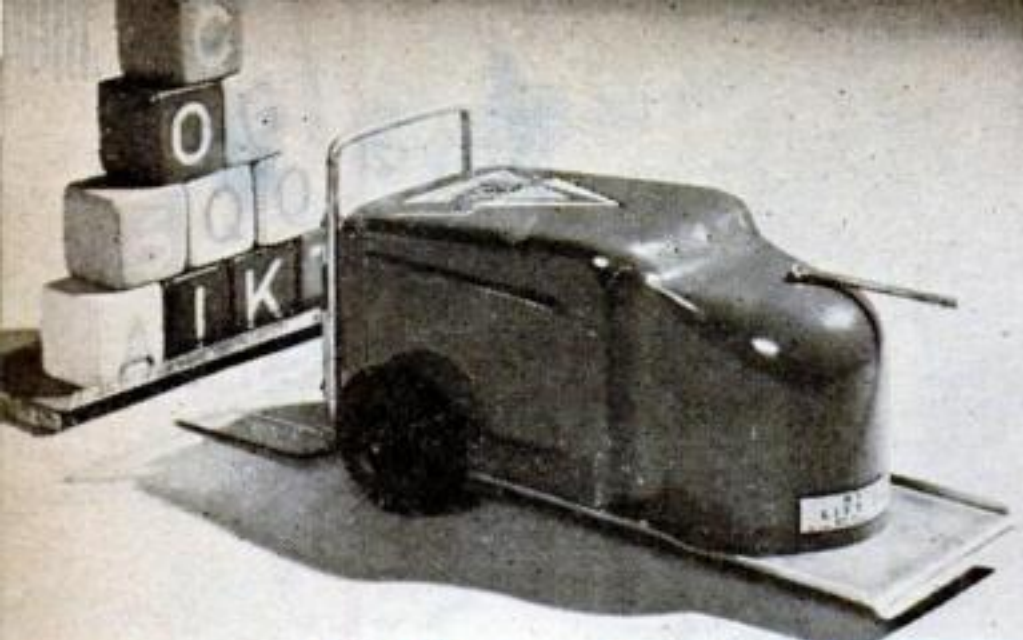
Control box turns current into five different voltages, according to which collector ring (center) is put into circuit by steering wheel and throttle. Voltage chosen sets speed of motors.



The operator of this Skyline Airport can take a plane out of hangar and taxi it to take-off point—without touching it. Lever at left moves a pantograph, under the field, with a



magnet on its tip. Magnet-equipped plastic plane then follows movement of magnet below it. When plane is hooked to wire on "flight tower," crank on edge twirls it by simple miter gears.



This clockwork lift truck goes after a load, picks it up, and brings it back to you. First moving ahead, it drops a platform so that it slides under the skid loaded with blocks. The truck then halts, and the platform lifts the load off the floor. Next the truck backs in a

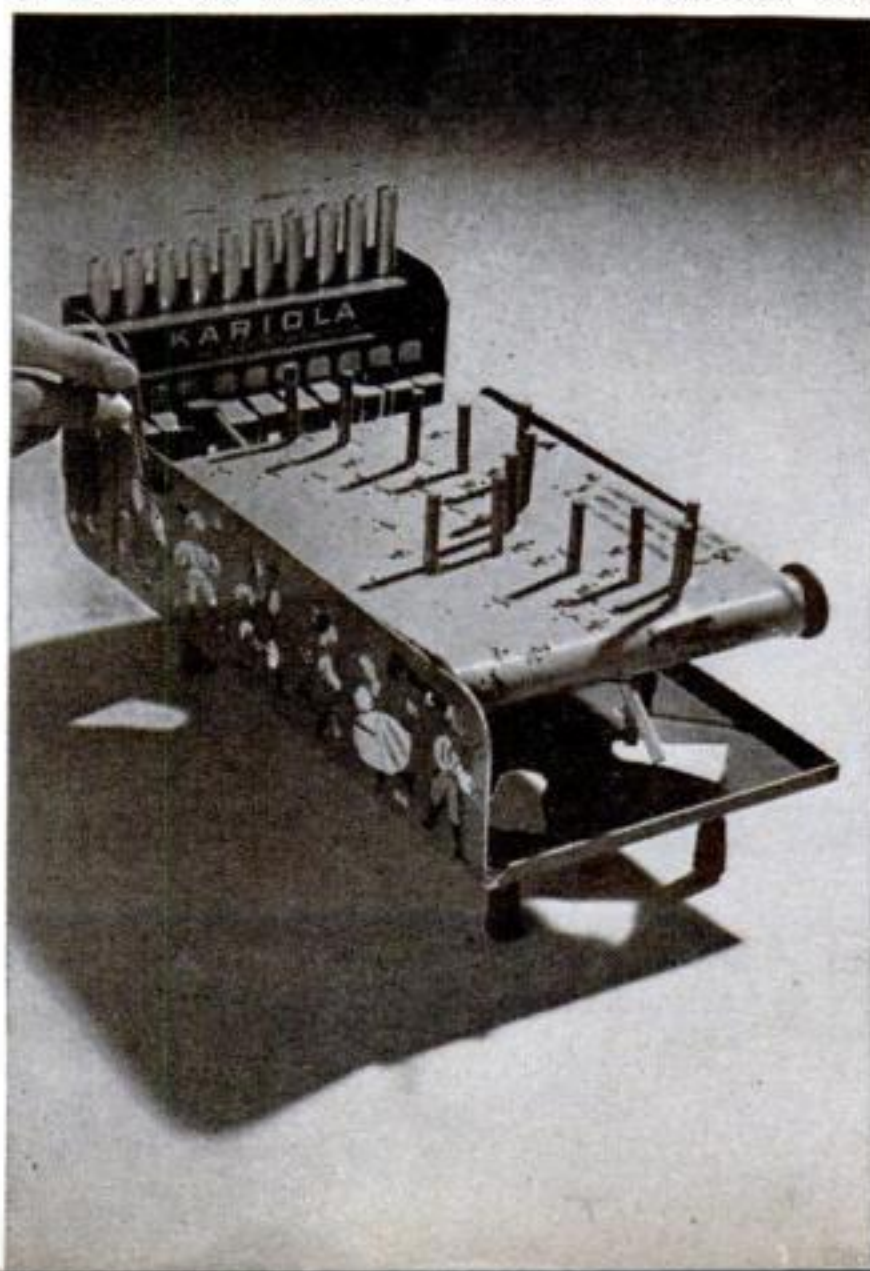
semicircle. When swung completely around, it goes ahead again. At the end of this forward movement, the platform drops and the truck stops. The photos show it going through its paces. In the picture at top right, the load has been removed so you can see the platform.

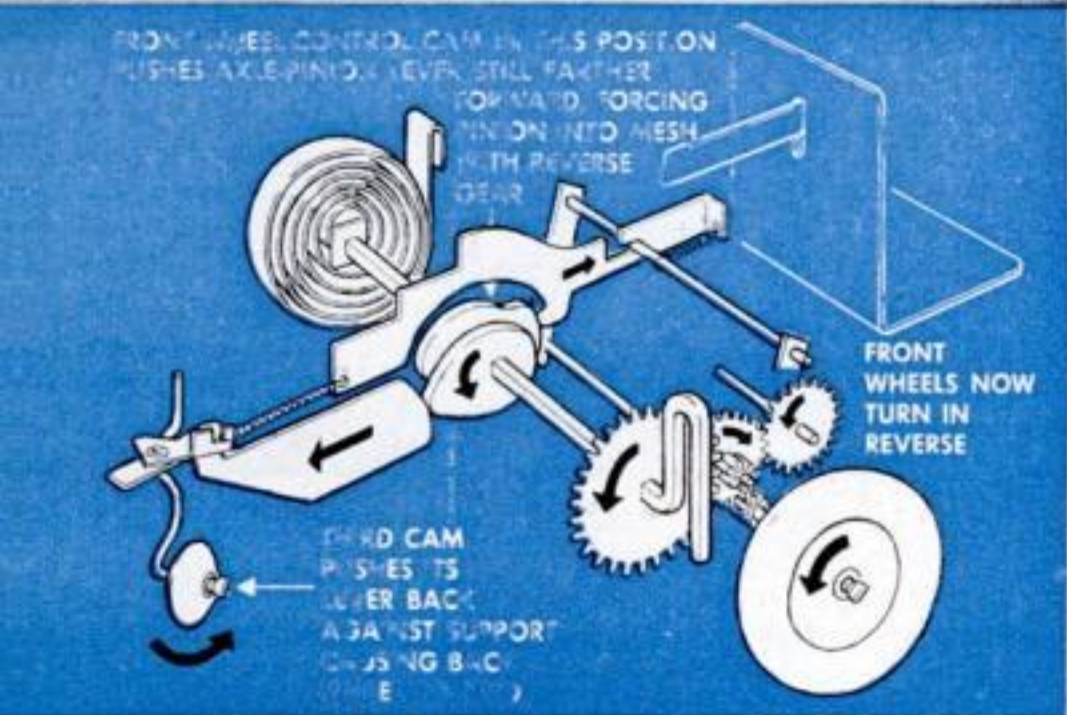
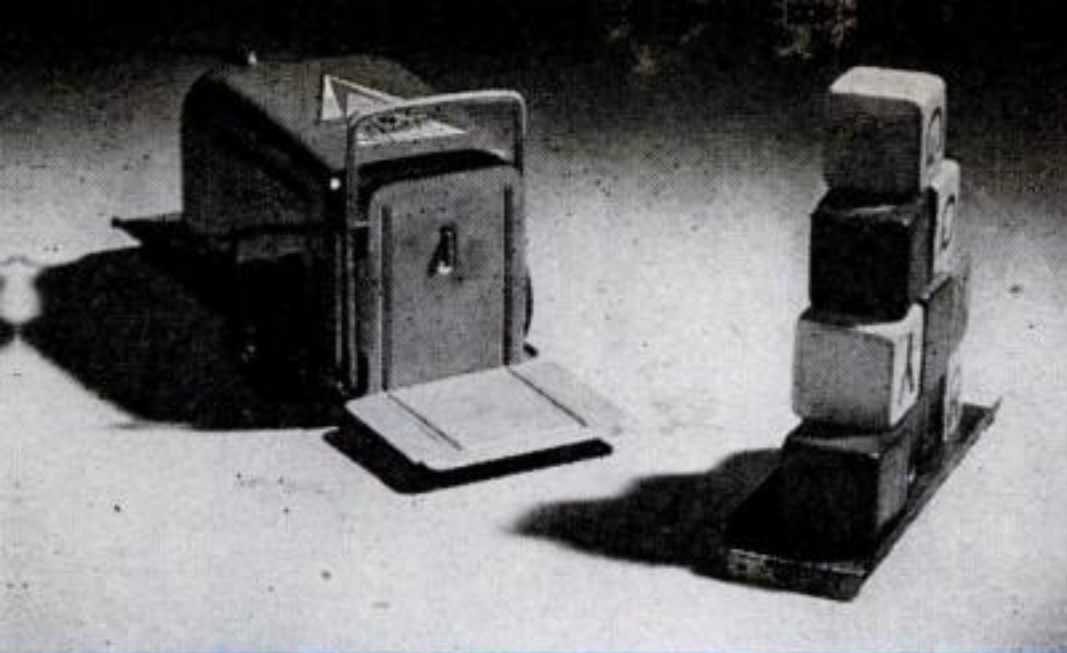
able to gather, however, some of the most interesting of the new toys—and take them apart to find what makes them tick.

For weeks, PS' offices looked like the back room of a toy shop. Tiny trucks came shooting through the mailroom, hotly pursued by panting photographers. Miniature houses sprang up like mushrooms on staid editorial desks. The halls echoed with the tinkling of Brahms' Lullaby. Artists sat for hours making an ingenious piece of clockwork go through its paces over and over again until they could figure out how it worked—and diagram the mechanism for you. Some of the clockwork devices put on a mass production basis are ingenious mechanisms worthy of a king's clock—or a first-class vending machine.

Don't worry if you find some of the new toys pretty complicated. Johnny will probably be able to run them, even if you can't. When PS researchers tried to run the electrically controlled truck (p. 101), they sweated over it for an hour, banging it into walls, backing it under furniture—and gen-

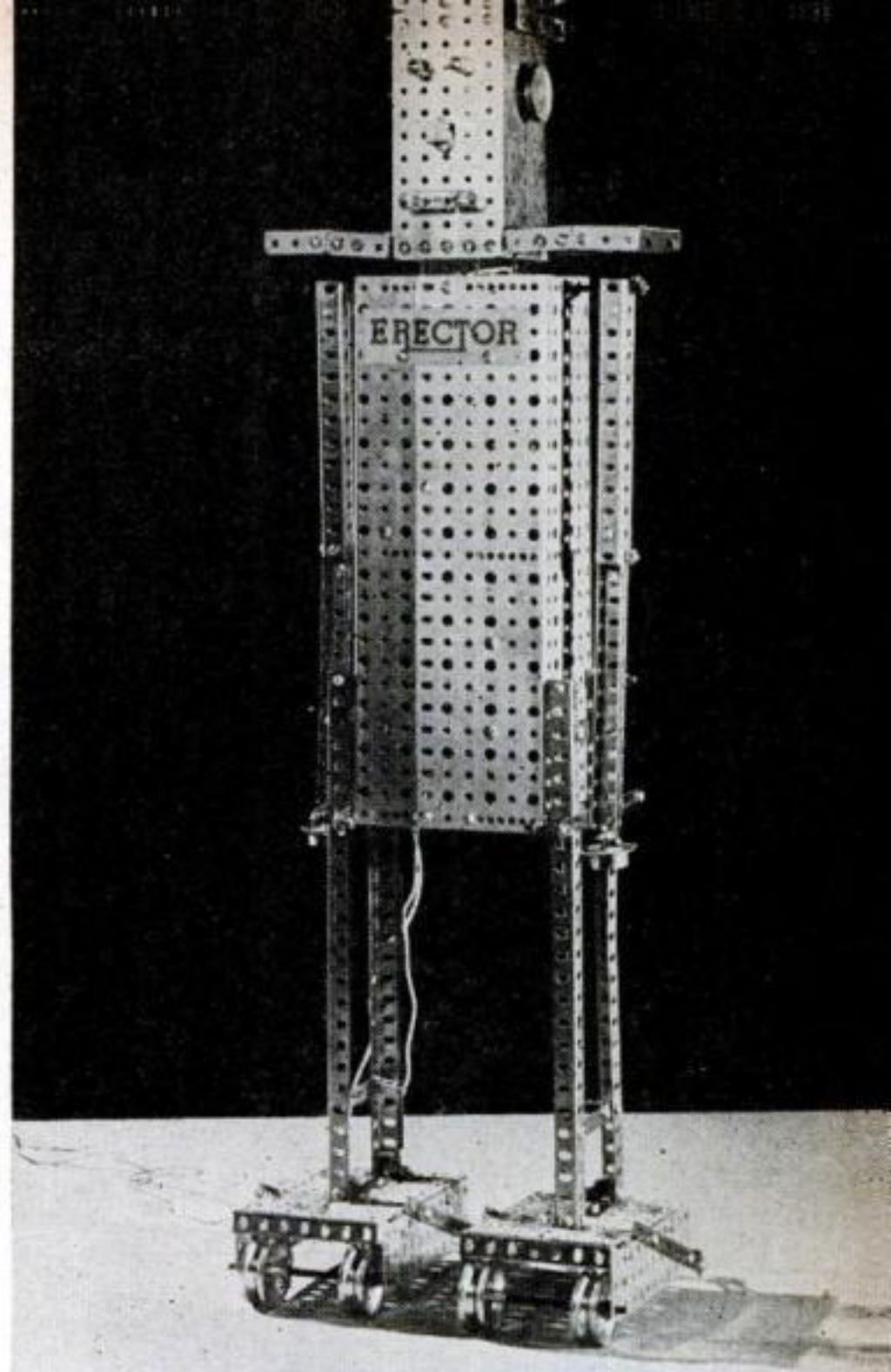
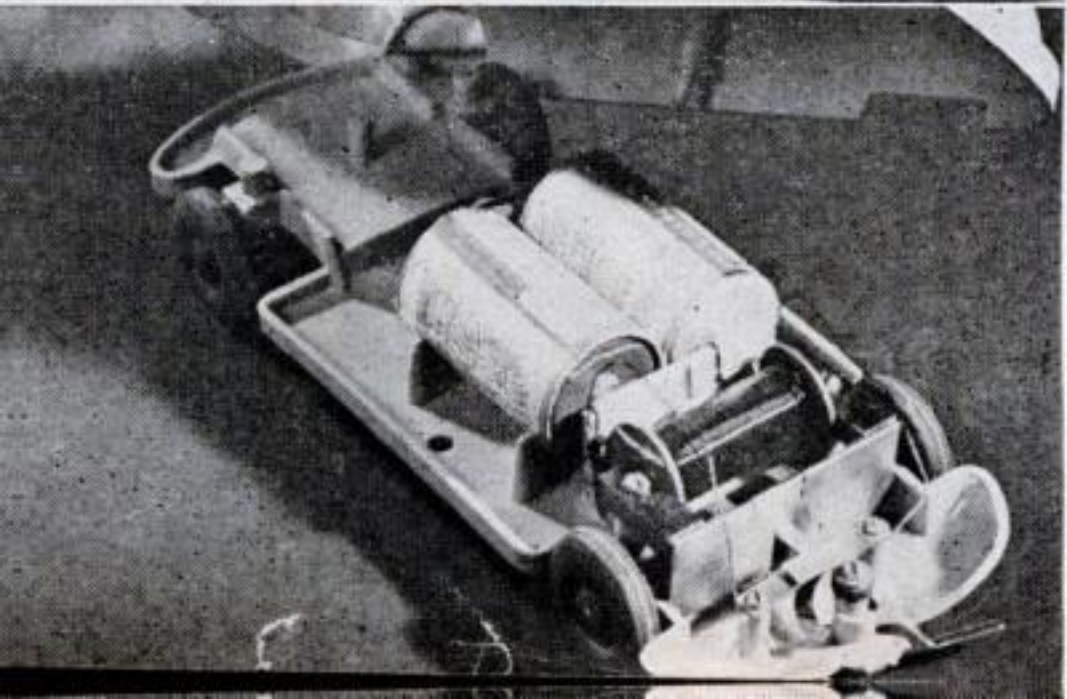
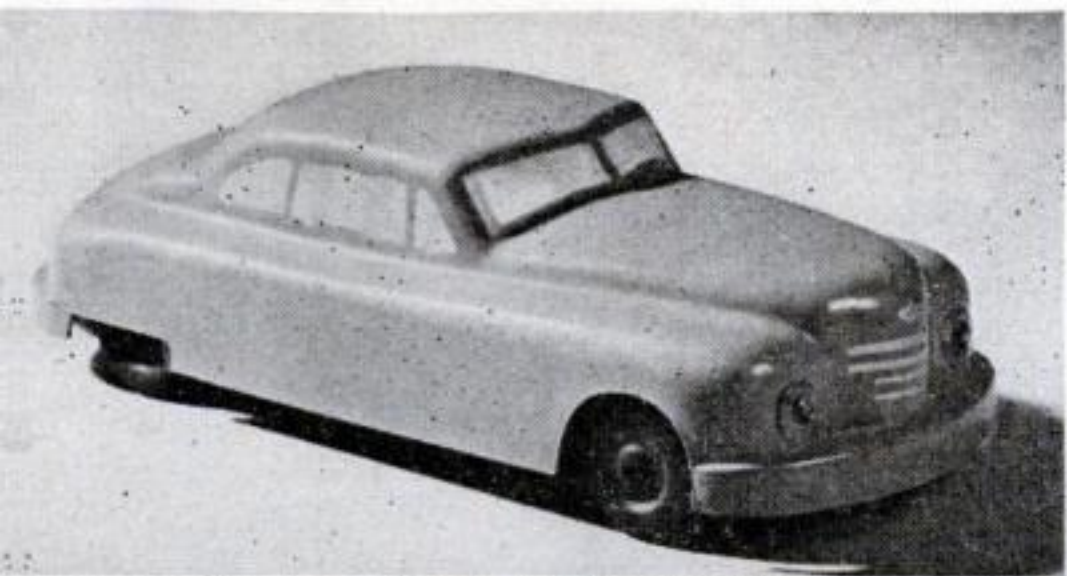
This Kariola[®] music box plays tunes according to the arrangement of pegs in holes in its belt. As the crank turns the belt, the pegs strike little hammers at the far end. These in turn hit metal tubes, producing the tune. It is made by National Scientific Products Co.





The diagrams under the photographs explain how the movement of a complex system of cams controls the entire sequence of action. The steering cam is shown only in the last diagram at right above. The truck is made by Ny Lint Tool & Manufacturing Co., of Rockford, Ill.

This Electrocar[®] reverses when it bounces into a wall. Little metal pushers, vibrated by magnet, rest on top of roller connected to an axle and push it ahead. A crash reverses the roller, forcing pushers to the underside. Now each vibration nudges roller—and car—backward.



Giant made from Erector[®] set walks when motors oscillate rods in his legs. Forward movement of rod slides leg ahead; on back stroke, "spurs" on giant's heels dig in, and rod slides up in hole instead of forcing leg back.





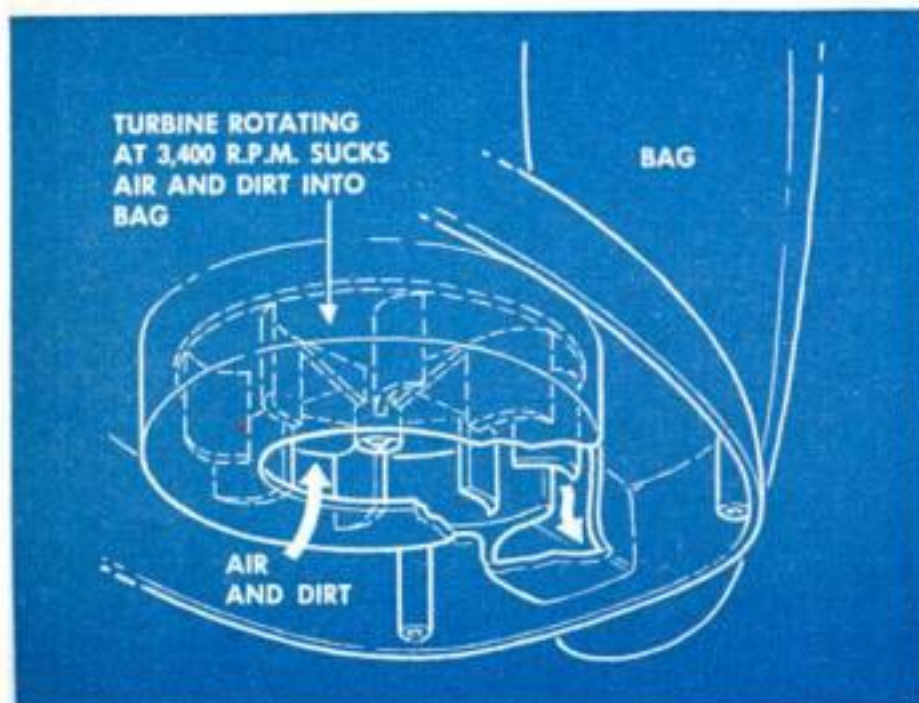
Lifelike doll coos if hugged, cries if spanked. Squeezing her forces air through a crumblike filler of foam rubber in her body and legs. This vibrates, gently or sharply, a reed in her

throat (cutaway, above). Protective screen keeps crumbs from clogging the voice mechanism. Made by the Ideal Novelty & Toy Co., Baby Coos® has a body of washable latex.

erally unable to control it. Then little Peter, who'd been invited in to have his picture taken with the truck, took over. In two minutes he had the vehicle under complete control—turning circles, speeding up, slowing down, just as he wanted.

We soon found we had to get *two* of everything—one to cut apart and one to leave with the kids we tried it out on! By reading this article, you won't have to buy more than one of a kind. And if you use the pictures with the young technicians, you won't have to commit a probably fatal operation on a new toy.

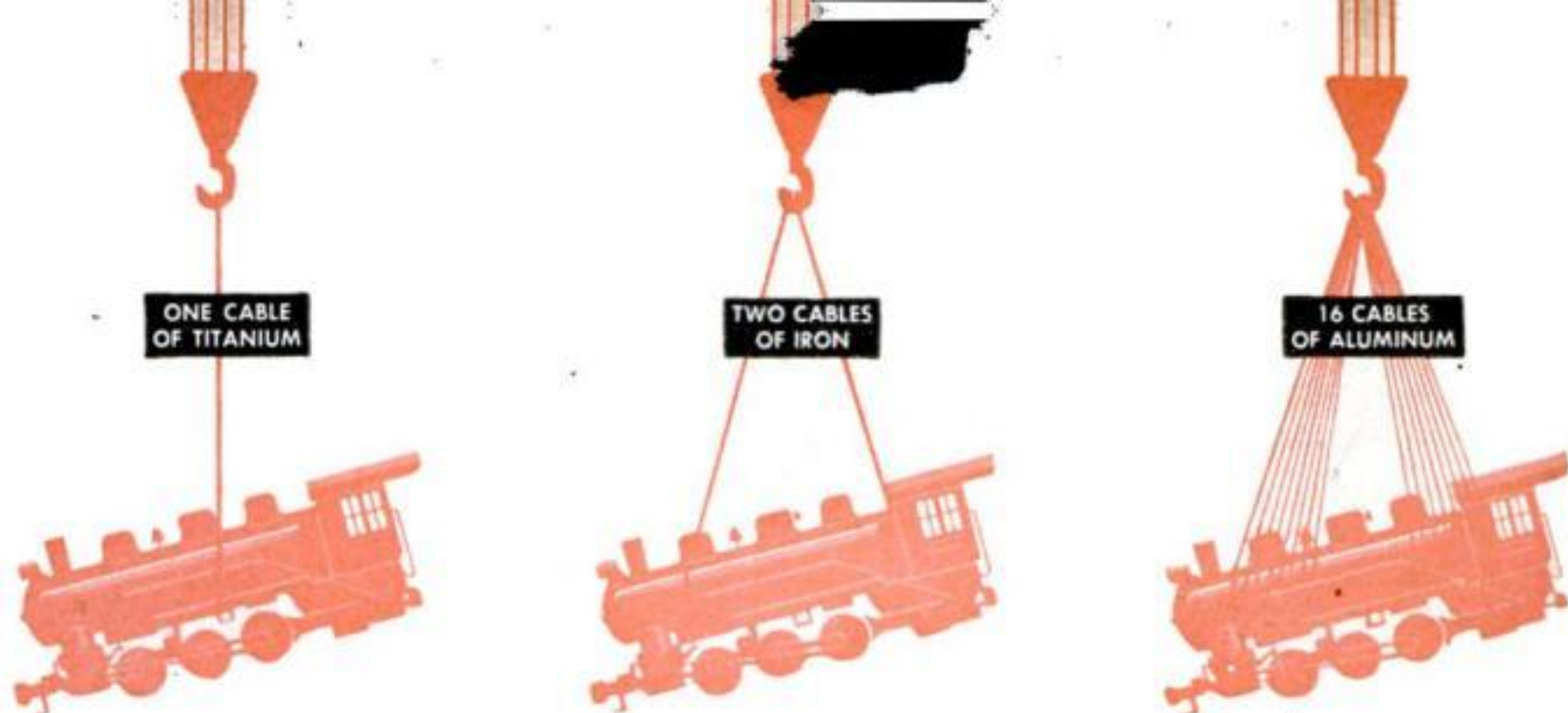
THE END



Just as in the real thing, a motor-driven air turbine sucks dirt into this undersized vacuum cleaner. Though there is no brush, the fan's high speed makes enough draft to pull in dust



and loose litter. And its horizontal position keeps the housing flat enough to get under low furniture. The working model cleaner is made by the National Scientific Products Co.



Titanium is twice as strong as iron and 16 times as strong as aluminum, as pictured here

by number of two-inch cables of each pure metal required to support weight of a locomotive.

New Strong, Light Metal Is Extracted

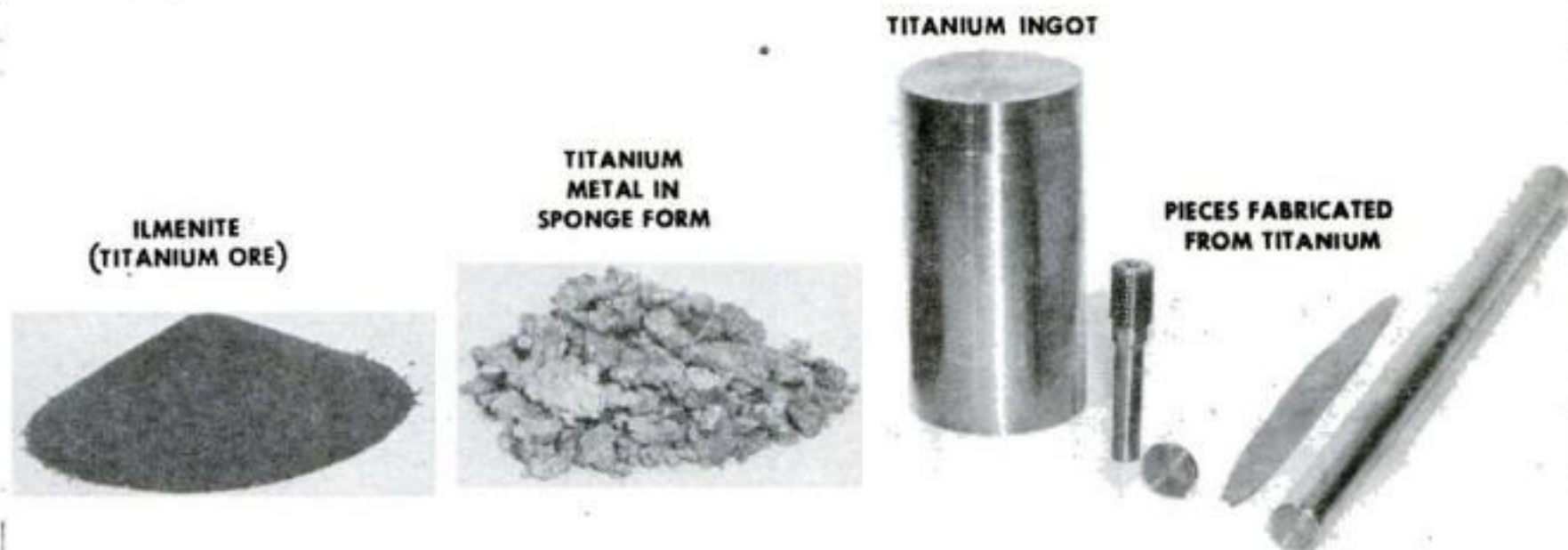
TITANIUM metal—a structural metal never before available to industry, although its ore is the fourth most plentiful in the earth's crust—now is making its debut in commerce. At Newport, Del., a duPont plant with a modest 100-pound-a-day capacity has just begun turning it out. When manufacturers awaken to its possibilities, mass production may follow.

Titanium's strength and lightness promise to make it rival aluminum and magnesium

as a material for airplane wings, pontoons, and cables. Since it resists corrosion, it may also replace stainless steel, an alloy that the U. S. must import chromium and nickel to produce.

Titanium is a pure, ductile, silvery-white metallic element, midway in weight between aluminum and iron. It has twice the tensile strength of iron, four times that of magnesium, and 16 times that of aluminum. Alloys consisting largely of titanium, when developed, may prove superior to other alloys.

America has vast reserves of titanium; only aluminum, iron, and magnesium are more abundant. How to extract titanium from its ore was the long-puzzling problem that the U. S. Bureau of Mines recently solved by treating compounds in a furnace with molten magnesium. Its usefulness far outweighs its relatively high cost per pound, \$5 now and possibly \$1 eventually.



Ilmenite ore, a black sand, yields titanium metal and its products in the steps shown above.

The New Buicks: Slicker, Smoother

THE big news about the new Buicks is, again, Dynaflow®. This revolutionary automatic transmission, tested on the fanciest '48 Buicks, will be available in most of the company's 1949 models.

Introduced less than a year ago (PS, Feb. '48, p. 113), Dynaflow has been available so far only as optional equipment in the Roadmaster. Now Buick is making it standard in Series 70 cars and offering it at extra cost in the smaller Series 50s.

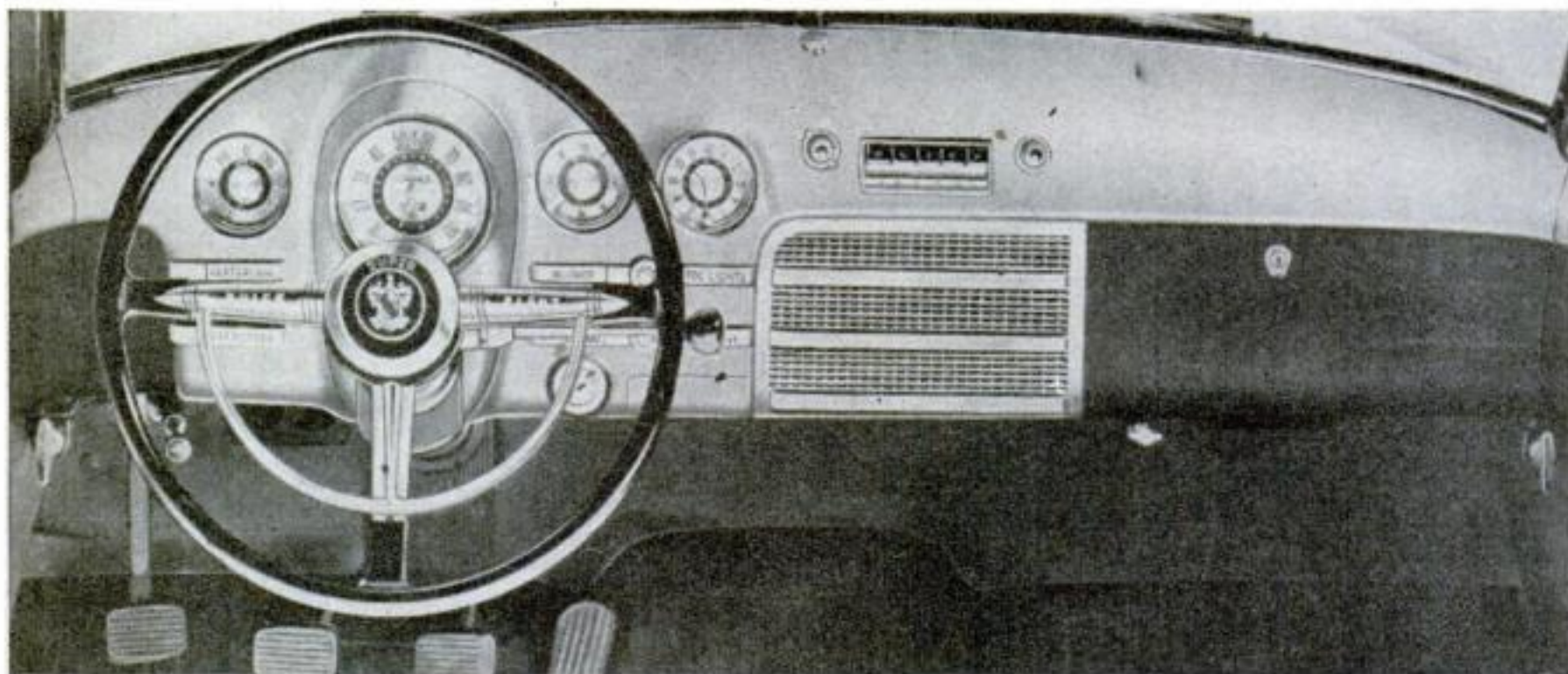
Beyond that, Buick's changes for '49 add up to a smoother line here, a mechanical

refinement or structural adjustment there.

Frames and bodies have been stiffened. New hydraulic lifts quiet the engine's overhead valves. New rear lamps combine the jobs of stop light, tail light, directional signal, and reflector.

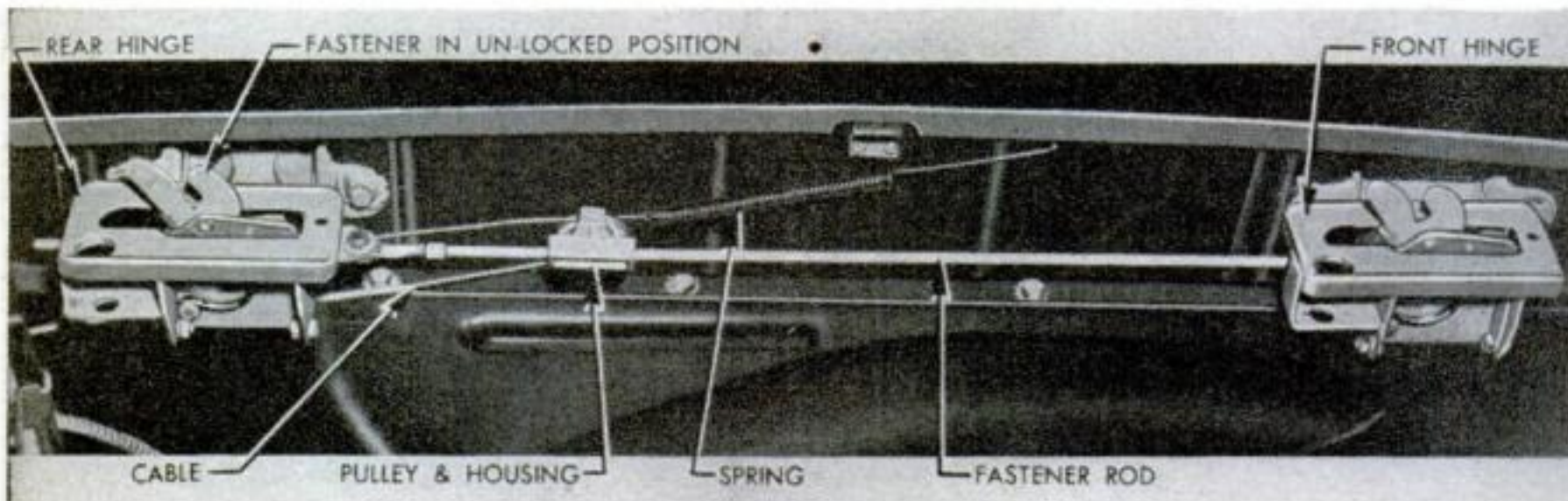
For simpler trouble-shooting, all electrical fuses have been put on a single panel behind the dashboard. Lowering both the front and rear coil springs, the company says, gives a softer ride.

But what Buick's proudest of is more Dynaflows.



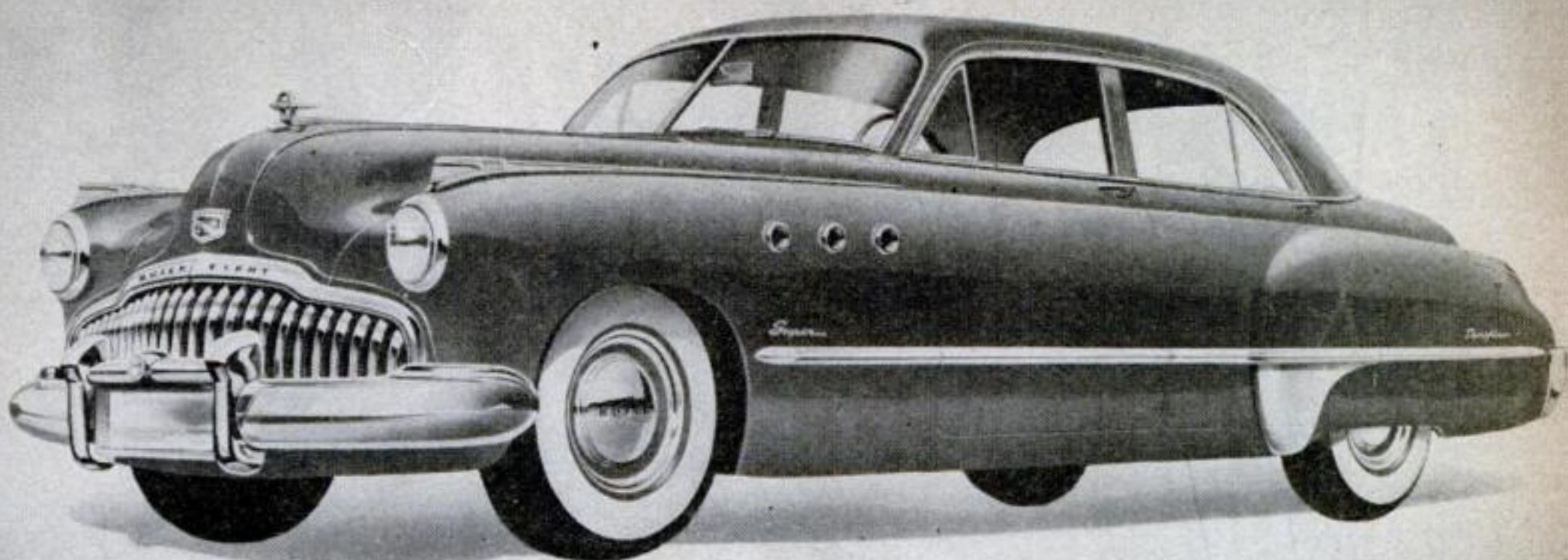
Instruments, centered in front of steering wheel, are recessed into dashboard and indirectly lighted to reduce glare. All panel controls operate on push-pull rods. Increased insulation

behind dashboard and a bellows around accelerator rod keep out engine heat. Pedal at extreme left is new foot-operated parking brake. Starter switch won't work when car is in gear.



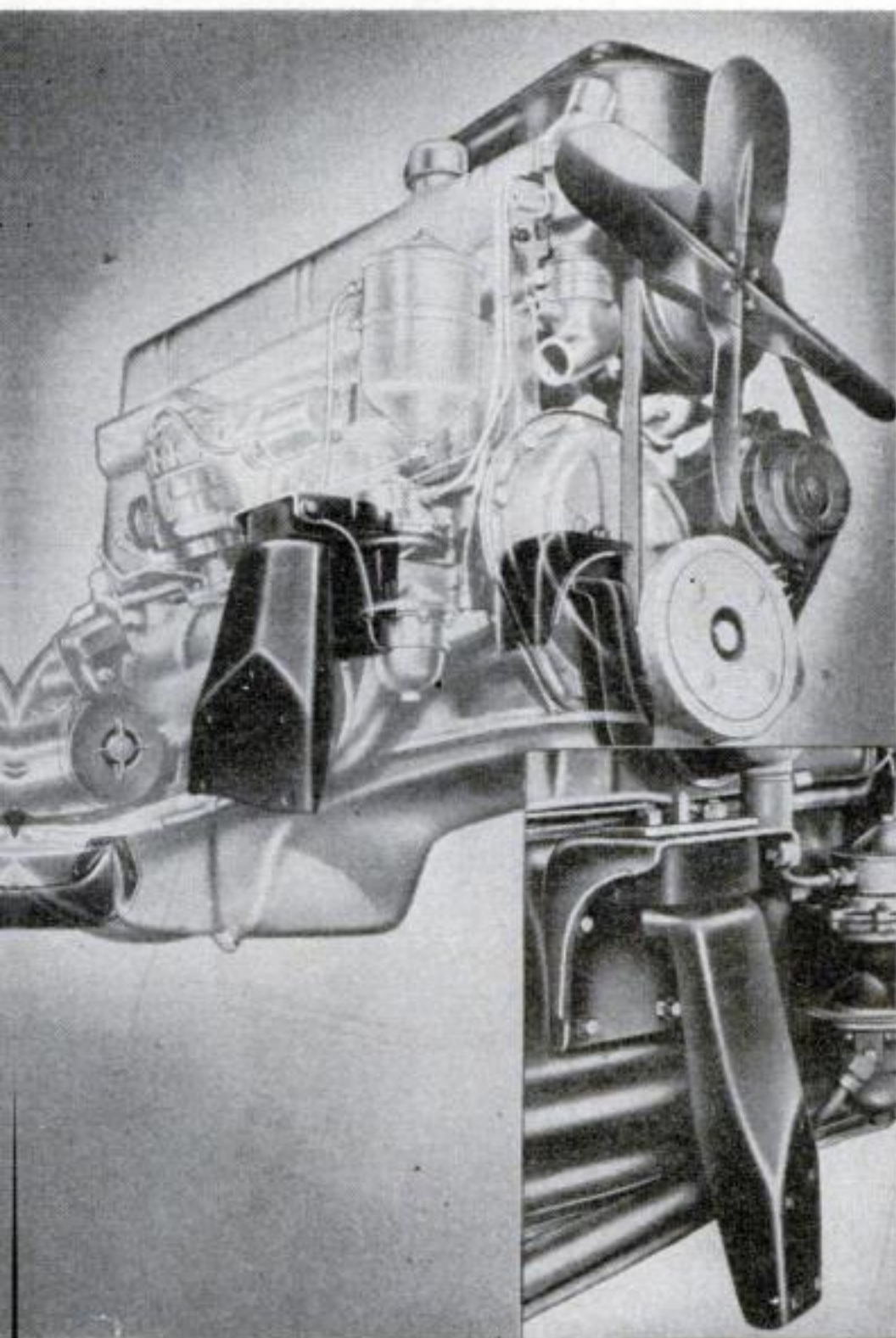
New latches of side-opening hood are operated by levers under dashboard. A pair of them (above) holds each side of hood. Front and rear hinge latches, held by same rod, unfasten simul-

taneously at pull on spring-loaded cable. When latches on one side are unlocked, pair on other side serves as hinges for one-piece hood. When both sides are unlocked, hood can be removed.



Sedan models of 1949 Buick have more than 25 sq. ft. of glass area, an increase of 22 per cent over 1948. Windshields are curved, and

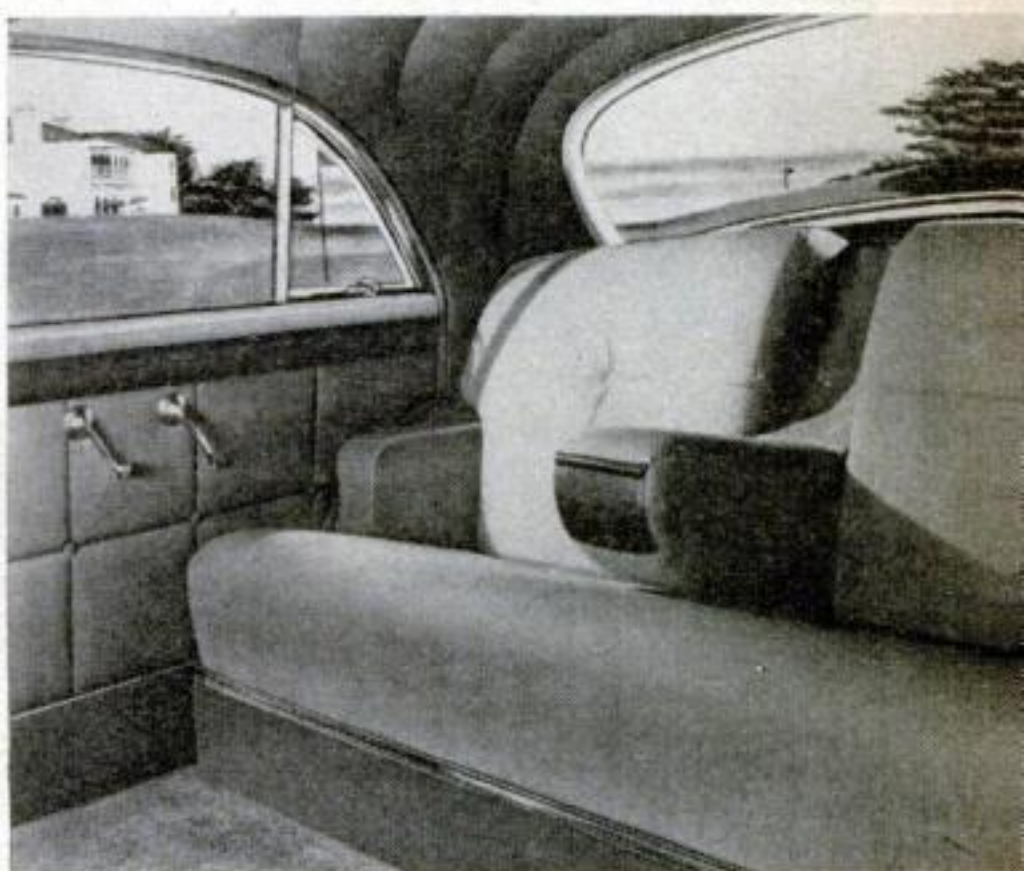
bodies have been slightly more streamlined by keeping rear-wheel shields flush with fenders. Wheel bases have been reduced about 3 inches.



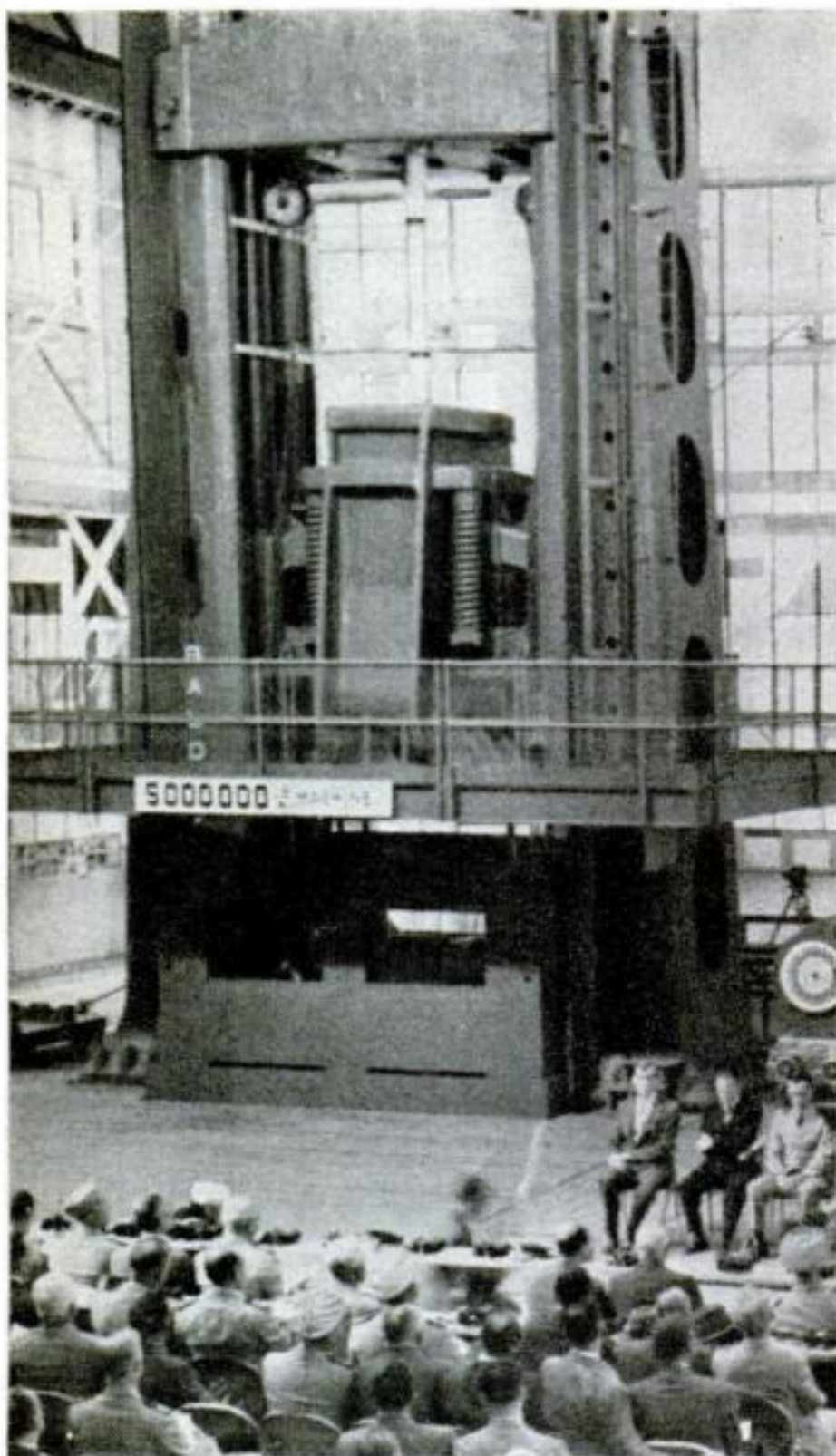
Vibration is reduced by anchoring engine on synthetic rubber at two points near front (inset) and one at back. Rear mount includes separate support to take driving thrust from rear wheels.



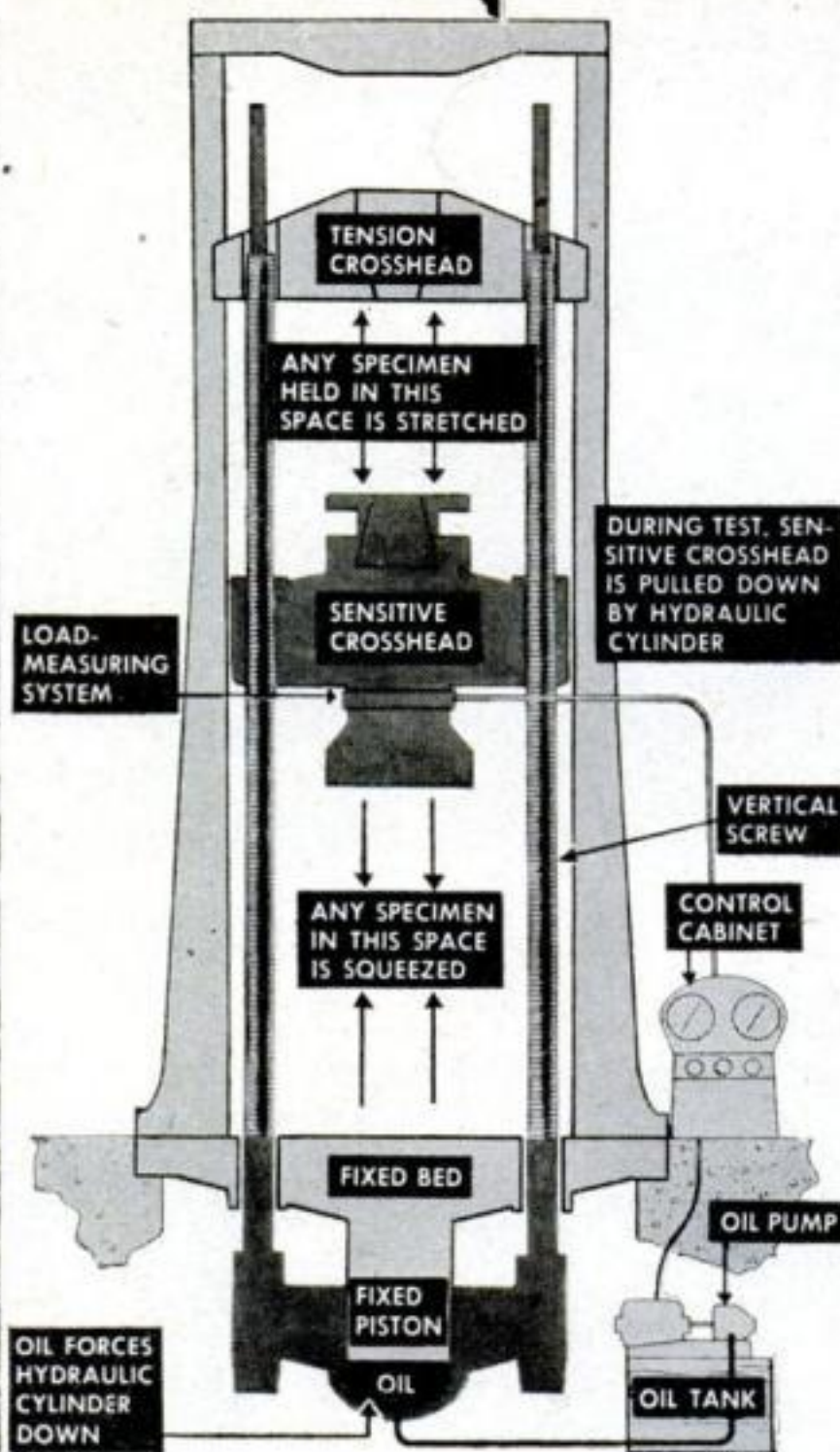
On station wagons, wood paneling has almost disappeared from sides but is still used across back. Door posts are thicker than 1948's in all models. New hinges let front doors open wider.



Rear seat can be split by armrest that folds up flush with back cushion when not wanted. Footrests built into floor assure full leg room even when adjustable front seat is shoved back.



World's largest testing machine is demonstrated at Naval Air Material Center, Philadelphia. The press rises 47 ft. above the laboratory floor and extends 16 ft. below it. Catwalk elevator surrounding the machine is used for preparing test specimens and observing the results.



Before squeeze, vertical screws lower sensitive crosshead to test specimen. Oil under pressure then forces down hydraulic cylinder, bottom, pulling crosshead toward stationary piston. For stretching, objects are placed between the sensitive crosshead and the tension crosshead, top.

Five-Million-Pound Squeeze

A TESTING machine that can crush a locomotive or gently crack a walnut has joined the Navy. It will put an experimental squeeze on full-size airplane parts that must withstand the terrific stresses and strains of flight.

Weighing almost a million pounds, the big machine will take specimens 10 ft. wide and 30 ft. long and use huge forces to squeeze and stretch them. In bending tests the press will handle specimens 50 ft. long. Under a hydraulic pressure of 2,500 lb. per square inch, the machine will exert

a load of 5,000,000 lb., yet the weighing mechanism is so delicate it can measure changes in load as small as four pounds.

Designed primarily for testing aircraft materials, from full-size structural members to the thinnest aluminum sheeting, the machine is expected to help solve the critical problem of making lighter aircraft carry heavier loads. Built by the Baldwin Locomotive Co., under sponsorship of the Navy's Bureau of Aeronautics, the press will be made available for tests by other government agencies and scientific institutions.



Graduates of Williams Air Force Base ride Lockheed F-80s in close-order drill over Arizona's Salt River Valley. Students learn precision

flying in the highly maneuverable jets, not for show, but as exercises in aerial tactics. In this formation, the planes protect one another.

How Jet Jockeys Are Made

Pilots trained in propellered planes find the winged blowtorches different—but actually easier to fly

By John F. Loosbrock

HIGH above southern Arizona's barren mountains a student jet jockey—a member of that new breed of pilots who fly the out-size blowtorches—suddenly hears a buzz above the monotonous hiss of the wind past his canopy. His control stick flutters.

He glances sidewise at the trailing edge of an aileron. It looks fuzzy. It's vibrating. That's the pay-off. He knows he is approaching the region of compressibility where his U.S. Air Force jet-driven plane is ramming along at four-fifths the speed of sound.

The buzz, the stick flutter, the fuzzy appearance of the aileron's edge—all bring to mind the rule on page 23 of the Student

Pilot Manual issued by the Williams Air Force Base for jet transition training. The rule says:

"Throttle back and reduce airspeed by extending dive flaps."

It's that simple. If a man follows the rules, he's not likely to get into trouble in a jet. A jet, in fact, is easier to fly than a propeller airplane. The old-timers at Willie—everybody knows the Williams base as Willie—told me so. In a jet, a man doesn't have so many things to watch.

But jets *are* different. A student learns right off to stand away from the tailpipe when a pilot fires up. The fiery gale that roars out of it could cook you to a crisp. But the sheer blast of it won't let anyone get that close. Still, it's plenty hot, and the specks of carbon thrown out sting like hornets.

A student learns that a gas turbine requires no warm-up. Once the engine is turn-

ing at full r.p.m., the plane is ready to take off. He learns that it is inclined to "float" in landings because its ivory-smooth skin has few projections to catch the air and slow its speed. He learns not to attempt another take-off after a touchdown unless he has a couple of thousand feet of runway still ahead of him: a jet accelerates slowly.

He learns not to be alarmed when a miniature snowstorm swirls about his head. That's only the refrigeration system sucking vapor out of the air and freezing it so fast that it blows into the cockpit. He learns never to start an intentional spin under an altitude of three miles. Every full turn the airplane makes erases 1,000 feet of height.

An apprentice jet jockey is hustled into high speeds quickly. Yesterday's students started on a clunker that bellowed along at 90 miles an hour and in time progressed to a fighter that did 350. Today they start on planes that make 200 to 300, and almost before they need a haircut are flying faster than yesterday's aces.

New Sensations, New Jargon

Everyone takes jet propulsion for granted at Willie. I caught on quickly myself when I visited the base, known formally as the Advanced Single Engine School of the Air Training Command.

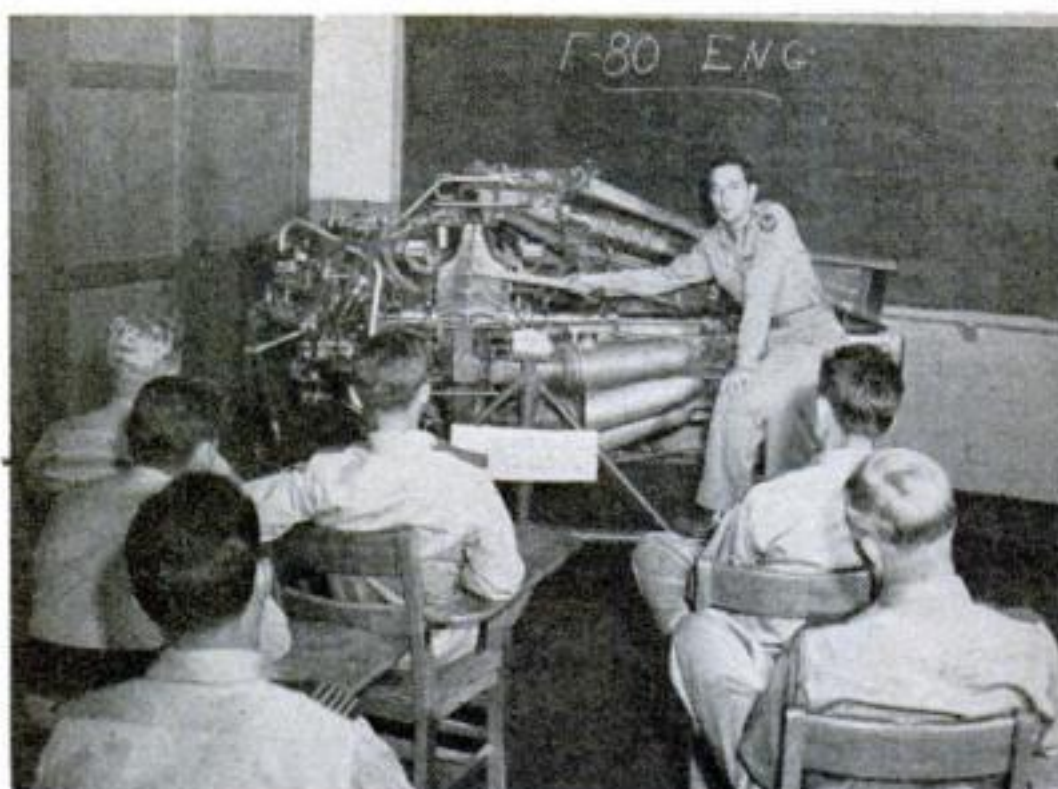
There, on the edge of the desert, within eyeshot of the plush dude ranches that dot Arizona's Valley of the Sun, I learned about jets through the sweetish, smoky odor of burning kerosene. I heard jets in the roar of the F-80s' engines. I saw jets in the glint of sun on polished wings.

The student there picks up a whole new jargon. He doesn't take off; he "leaps off." He doesn't step on the gas or push in the throttle; he "turns the wick up." When he overshoots or undershoots the runway, he "joins the desert club" or "lands among the tules." (Tules is a nickname for the scrubby desert plant life.)

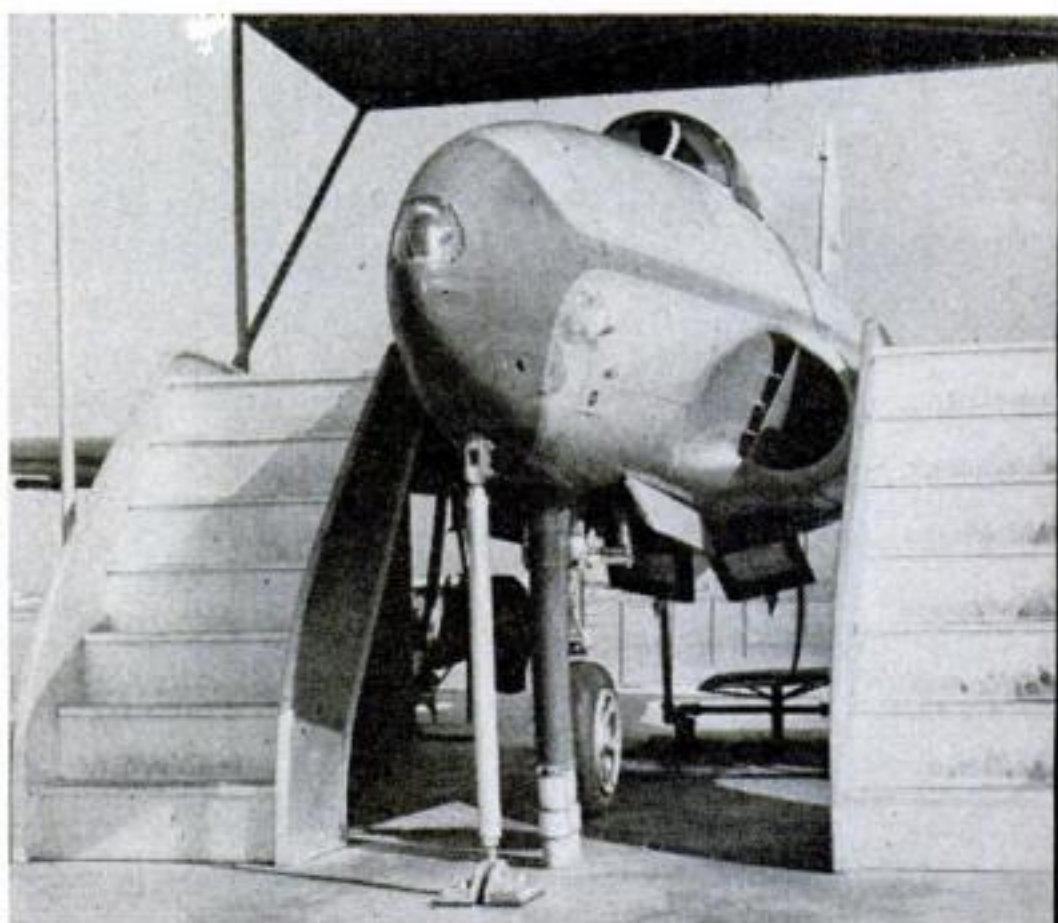
And if he gets in a tight spot and doesn't know what to do, he "pushes the panic button for two minutes of disorganized confusion." During his first few weeks he may even find the panic button "stuck in the on position."

As a cadet, he came to Willie fresh from basic training, where he flew 170 hours in the T-6, a 550-horsepower plane that was World War II's advanced trainer.

In his initial flights at Willie the jet student never leaves the ground. He "flies" the



Air Force cadets study Shooting Star's engine to learn what pushes the jet plane through the air. Cutaways and mockups speed intensive ground course that goes with jet flight training.

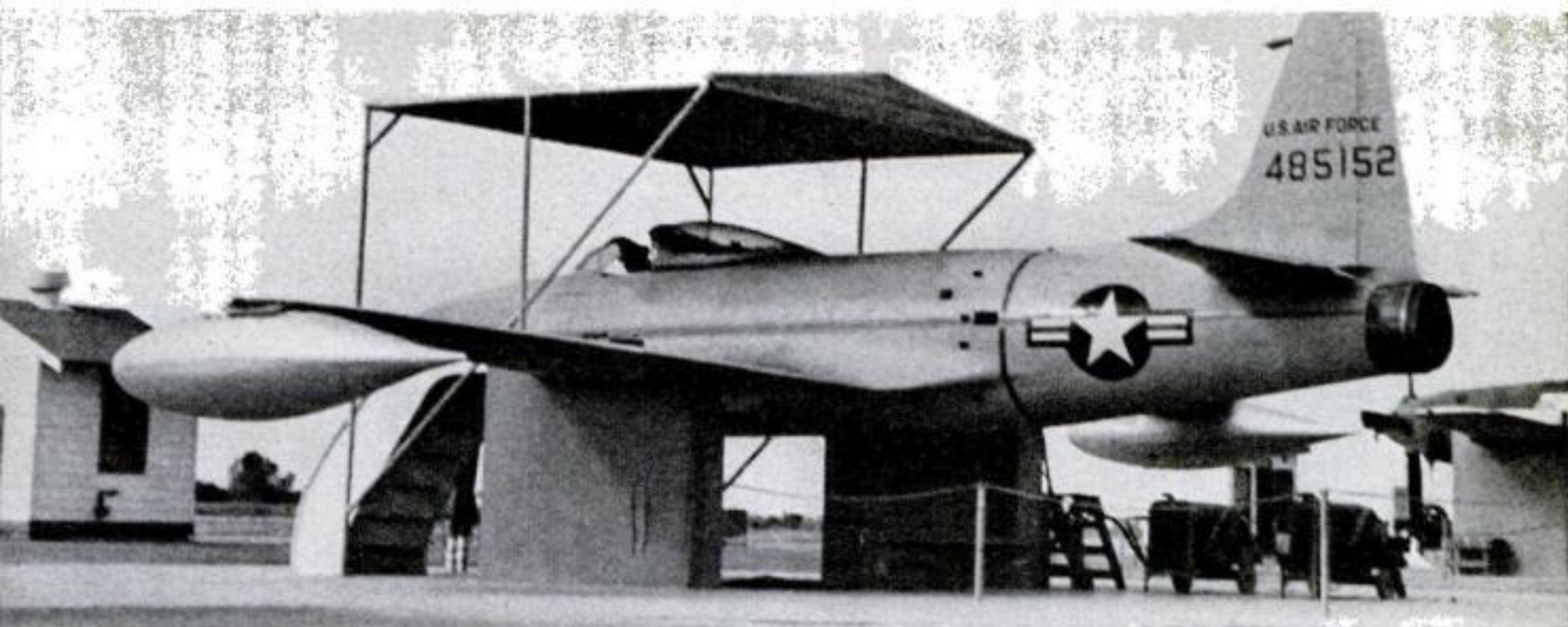


Nose-on view of the Captivair shows how landing gear can be lowered and retracted. Dive flaps, just behind landing-gear hatch, also operate normally in response to controls in cockpit.

Captivair, an operational plane mounted on concrete blocks that keep it earthbound.

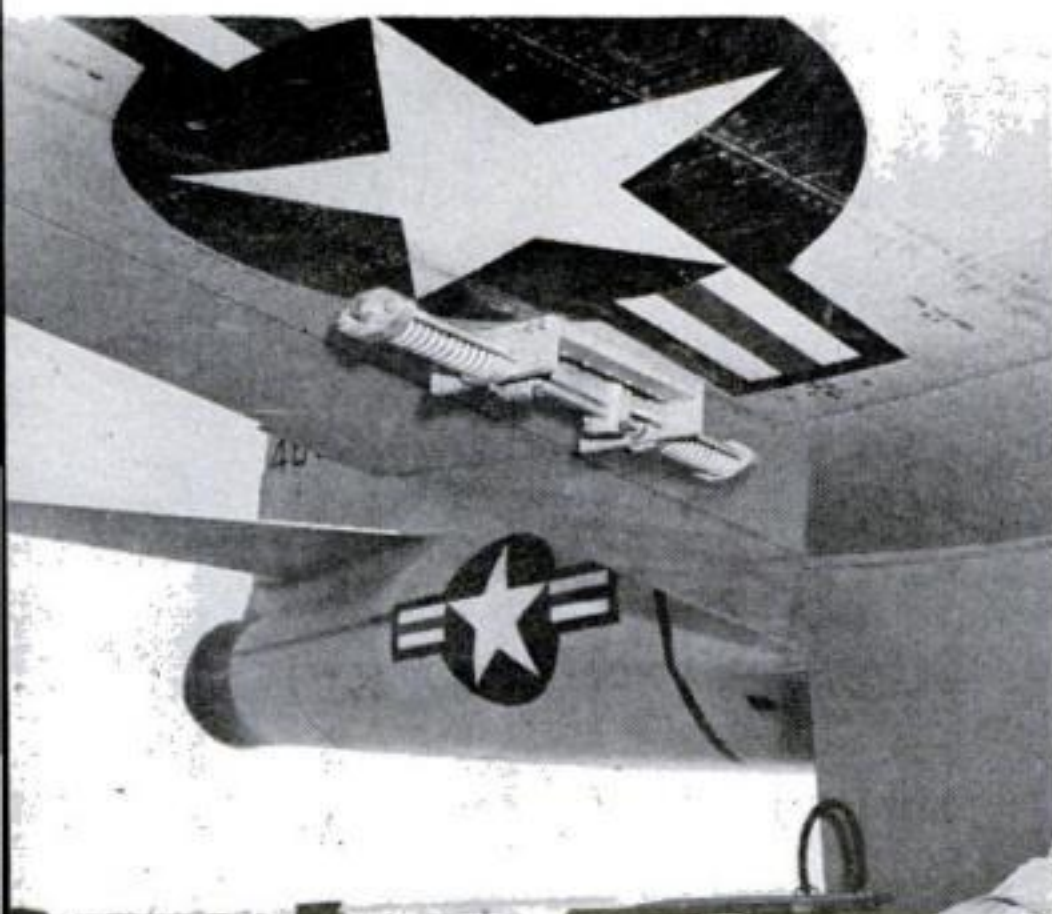
The engine of the Captivair has the normal blast-roar, developing about 4,000 pounds of static thrust at full throttle. The landing gear and flaps lower and retract. Stick and rudder operate as usual. The instrument panel is connected electrically to a nearby control house. Here an instructor, in telephonic communication with the student, feeds emergencies of all kinds into the Captivair's instrument panel.

He can simulate loss of fuel pressure, fail-



First flight by jet student is made in this Captivair—an operational plane, complete with engine, but anchored to concrete blocks. Instrument panel is connected electrically to near-

by shack, where instructor feeds problems to cadet and checks on how he handles them. If plane catches on fire, instructor can push a button to flood cockpit with carbon dioxide.



Wind resistance against the hydraulic aileron booster is simulated in the Captivair by heavy spring under the wing. This gives the stick the same feel it would have in actual flight.



Instruments in control shack show instructor how earthbound plane is behaving. From another panel, controlling cockpit instruments, he can make the student's dials register trouble.

ure of the hydraulic system, a "flame-out" (power failure in the air), and then tell his victim what to do. He can make those dials spin so crazily that vertigo turns a man's knees to rubber. No one has bailed out of the Captivair yet, but the simulated emergencies become so realistic that the instructors feel it's just a matter of time until someone does.

A student starts the Captivair, "taxi" to take-off position, and calls the instructor (who acts as the control tower) for permission to leap off. When the plane is ready

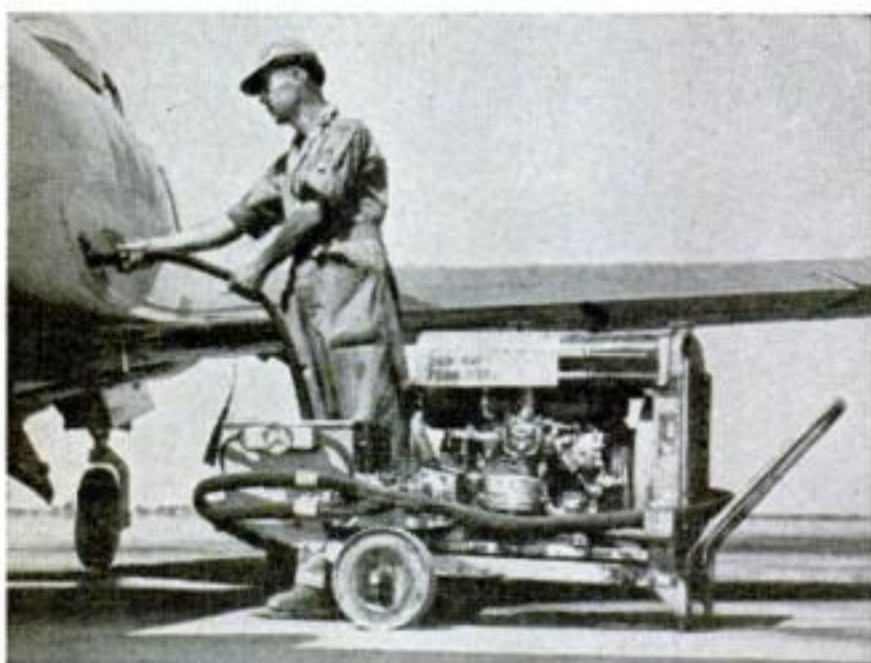
("Didn't you forget your flaps, Mister?"), he is cleared to go. The "airspeed" begins to build up. The landing gear comes up, and the altimeter simulates a climb. The fledgling jet pilot fights the piped-in malfunctions for twenty minutes or so and then the instructor "talks him down." He has done everything he could do in a jet except actually take it off the ground.

But no amount of briefing, Captivair time, or description can prepare anyone for his first jet flight. I know. I took one in the back seat of the new TF-80C, first and only two-



Students are briefed before training flight at Air Force school for jet pilots. They may be

cadets fresh from basic training or veterans of World War II combat in propellered planes.



Auxiliary power unit that can be rolled from plane to plane is used for starting jet engines to save drain on aircraft batteries. It pumps 28-volt current into electrical starting system.



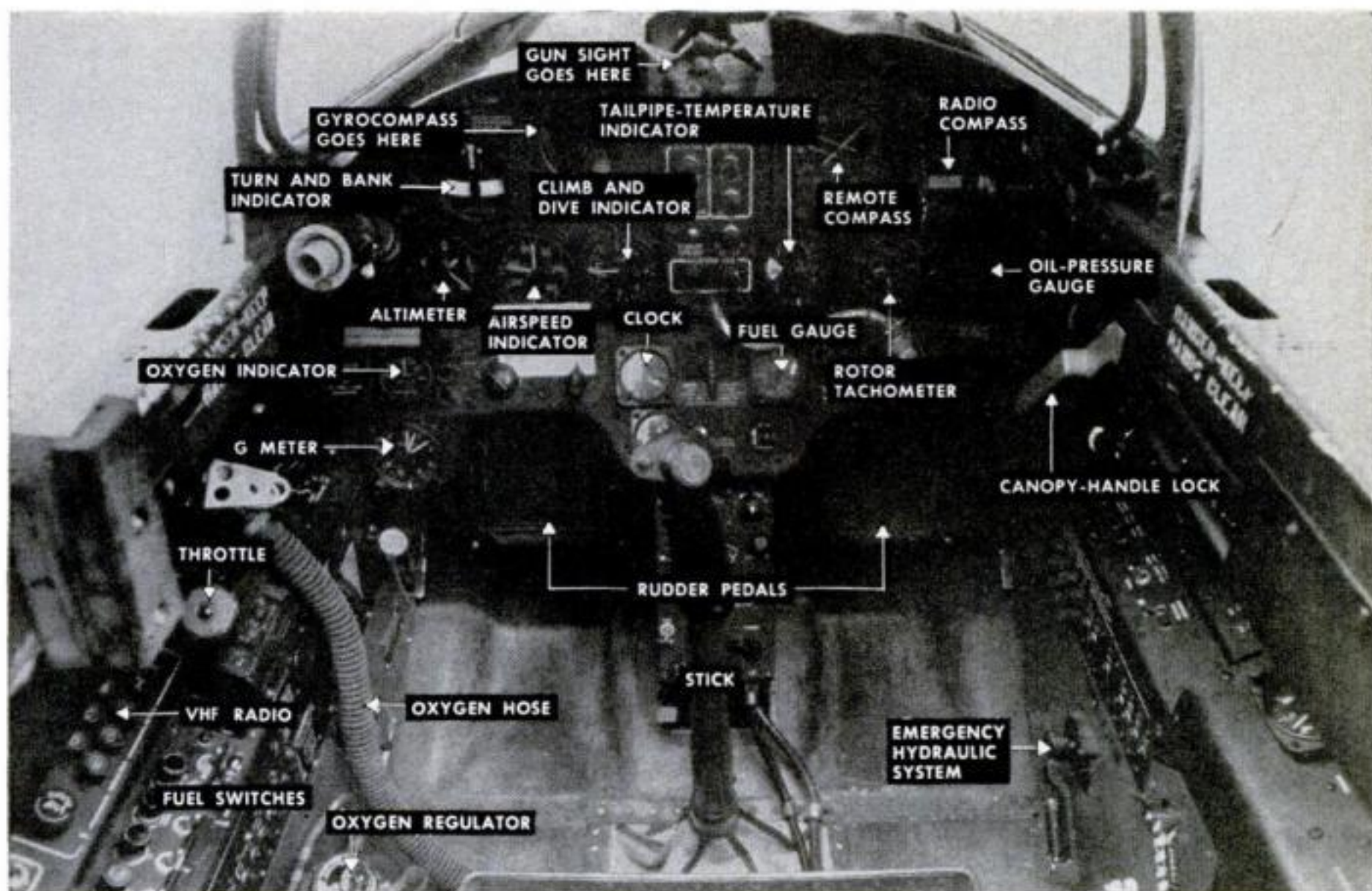
New two-place jet trainer roars down runway for take-off. Fuel tanks under wing tips can be dropped when empty. In actual fighter, the tank shackles may also be used to carry bombs.

place jet trainer. It's a standard Shooting Star, Lockheed-built, with the fuselage stretched out three feet to make room for the extra cockpit.

A crewman uses an auxiliary power unit on the electrical starting mechanism. This keeps the battery fresh for emergency use. The throttle is off, fuel switches on. The instructor pushes the starter switch. As the rotor wails up to speed, the instructor flips the battery switch, cuts in the emergency

fuel pump, and turns the wick up halfway. You hear a rumble as the flame catches. Off goes the emergency fuel pump, and the throttle slides back to "idle." At 18 percent r.p.m. the starter switch is released. The canopy is locked. The instructor opens the throttle to 98 percent and checks his instruments—hydraulic pressure, load-meter, oil and fuel pressure. You're ready to go without any delay to warm up the engine.

Taxi time is kept to a minimum. Every



Jet cockpit is simple compared to that of piston-engine plane. This is front (instructor's)

seat in new TF-80C trainer. Buttons on the stick fire gun-camera and release wing tanks.



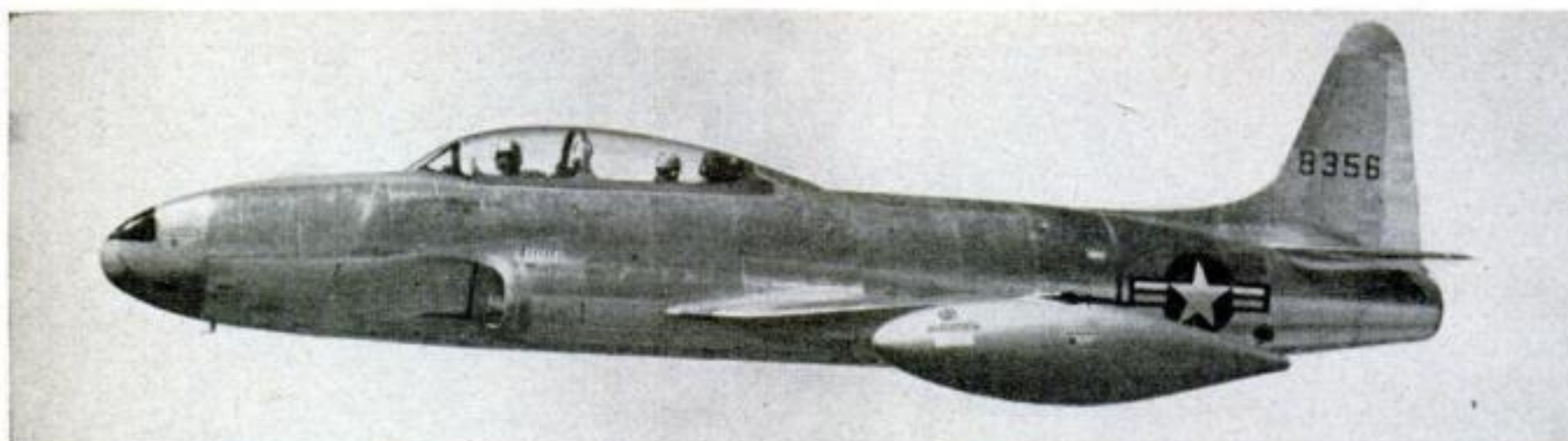
Mobile control tower keeps close check on student take-offs and landings. It can move to any runway, depending on wind. Here operator talks to pilot from radio mike on long cord.

minute the engine runs on the ground cuts seven miles off the plane's range.

Once the plane is headed upwind, the throttle slides forward, the brakes are released, and you're whistling down the runway. At a little better than 100 m.p.h., you're airborne; at 150, up comes the landing gear. Wing flaps are retracted between 150 and 200 m.p.h. The plane goes into the steep climbing turn that finds you at 2,000 feet before you can squirm into comfort in



Signal light, called "biscuit gun," flashes orders to students from mobile control tower. Trigger moves red or green lens in front of a lamp. Signal flares are used in emergencies.



New jet trainer, Lockheed TF-80C, is a Shooting Star fighter stretched out to make room for two seats. It speeds jet-pilot training by

letting students go directly into jets from basic flight school, instead of taking intermediate practice in fast engine-and-propeller fighters.

your parachute, shoulder straps, and crash helmet.

Now you get a little lesson in the flight characteristics of the trainer, which are identical with those of the single-seat fighter version. You zoom to 10,000 feet at a climb of more than 5,800 feet a minute. The instructor throttles back to bring on a stall. At an even 100 m.p.h., with the nose well up, the jet shudders and the right wing drops slightly. A touch on the left rudder rights it, and the nose "walks down" without another rudder move. The darn thing just won't stop flying.

Graceful, Smooth, Quiet

The plane leans gracefully into steep turns, with no skidding and barely a nudge on the rudder. The 80 definitely is an aileron ship. There is none of the roar and vibration of conventional engines—only the comforting rumble of air through intake ducts and the whistle of wind past the canopy. Engine noise is left far behind.

In coming down, use of the dive flaps is optional. After a level peel-off, the instructor lowers the landing gear at not more than 225 m.p.h. Wing flaps come down at not more than 200 m.p.h. He cuts the throttle back to about 50 percent r.p.m. and turns on the emergency fuel pump as he swings into the base leg of his landing pattern. He maintains at least 150 miles indicated airspeed until the final approach, when he throttles back to 130. With full flaps, he touches down at 120 to 125 m.p.h. The nose is kept slightly high to take stress off the nose wheel.

Once on the ramp, the instructor idles the engine between 35 and 40 percent r.p.m. until he retracts his dive flaps and wing flaps. Then he pulls the throttle back to "off" and turns off the fuel, battery, and generator switches. You're in.

After only two or three hours' dual instruction in the TF-80, a student who catches on fast is ready to take a jet up alone. By now he knows that his crash helmet is worn to protect his head from bumps when he gets into rough air at high speeds. He begins learning pin-point navigation—no mean trick at eight miles a minute. He learns cruise control to conserve his fuel.

Flight characteristics, landing and go-around stages, practical engineering, and altitude flights up to 40,000 feet complete his transition.

After 100 hours at Willie, including some instrument and navigating time in the T-6, which now seems like a lumber wagon, he's a jet-fighter pilot. He is ready to be assigned, complete with wings, to an operational fighter group.

Before the TF-80 came to Willie, jet students worked up to F-80s by flying 60 hours in fast reciprocating-engine fighters. Now they go all the way in jets.

The cadets selected for jets are not a hand-picked group, the Air Force emphasizes. Up to October, when I visited Willie, 534 rated pilots, many of them veterans of fighter combat, had been checked out on the F-80. Only one had washed out. And up to that time, 126 non-rated students had received their jet-propelled wings. Even among the cadets the washout rate is low, running from 3 to 5 percent.

But Brig. Gen. Thomas C. Darcy, then base commander, now in Europe, thinks even this percentage is too high. "We shouldn't have to wash out any," he said. "A little tighter screening in basic training would make our average 100 percent."

For pilots like jets. As one veteran fighter pilot said after his first ride in one, "Brother, this is what the Wright Brothers had in mind!"

END



Compact Aircraft Radio Runs in Cooling Bath

TO SAVE space, the tubes in this radio are so close together that, under ordinary conditions, the set quickly overheats. But submerged in a tank of liquid freon, as shown above, the set works fine.

Air Force engineers dunked the radio as an experiment, part of their search for safe ways to reduce the size of electronic equipment in new planes. The freon, commonly used in refrigerators, draws heat rapidly away from the tubes and spreads it over the walls of the tank. If that's not enough to keep the radio from overheating, the freon then starts to boil and cools it even faster by evaporation. The "steam"—freon gas—condenses on the tank's roof and drips back.

This cycle—boiling and condensing—keeps the radio from getting any hotter than the boiling point of freon. And since that varies with the pressure, the maximum heat of the radio can be controlled by regulating the pressure in the sealed tank.

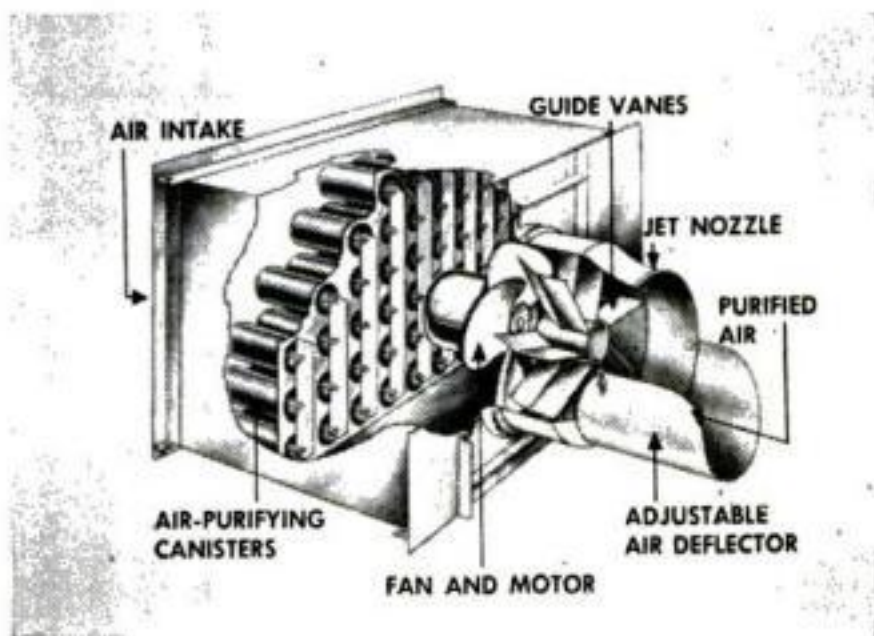
Because freon is noncorrosive and does not conduct electricity, it neither harms nor shorts the radio—in fact, the liquid protects the set from atmospheric damage.

The radio-reducing program, conducted by the Air Materiel Command at Dayton, O., also includes development of smaller parts. Some tubes have been reduced in size by 95 percent—and work just as well as ever.



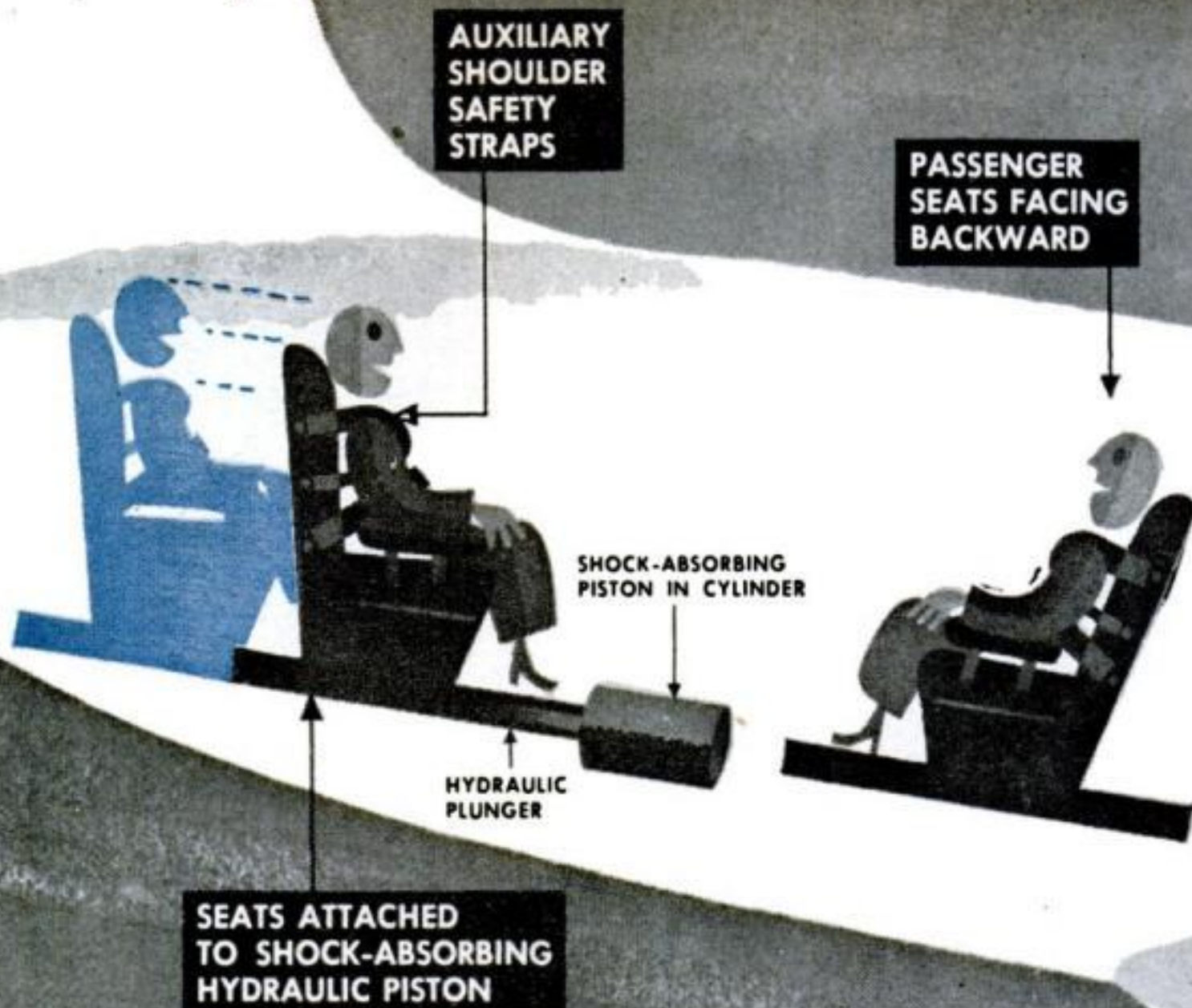
Wheel Flips Tin Plate

THESE mechanical fingers speed inspection and leave no messy prints on tin plate in a new U. S. Steel mill at Pittsburg, Calif. The fingers are fiber-tipped spokes of a five-ply, rimless wheel. Coming up between the rollers of a conveyer, they lift off one sheet at a time, flip it over—so the inspector can scan both sides—and lay it back on the conveyer.



Fan Keeps Apples Young

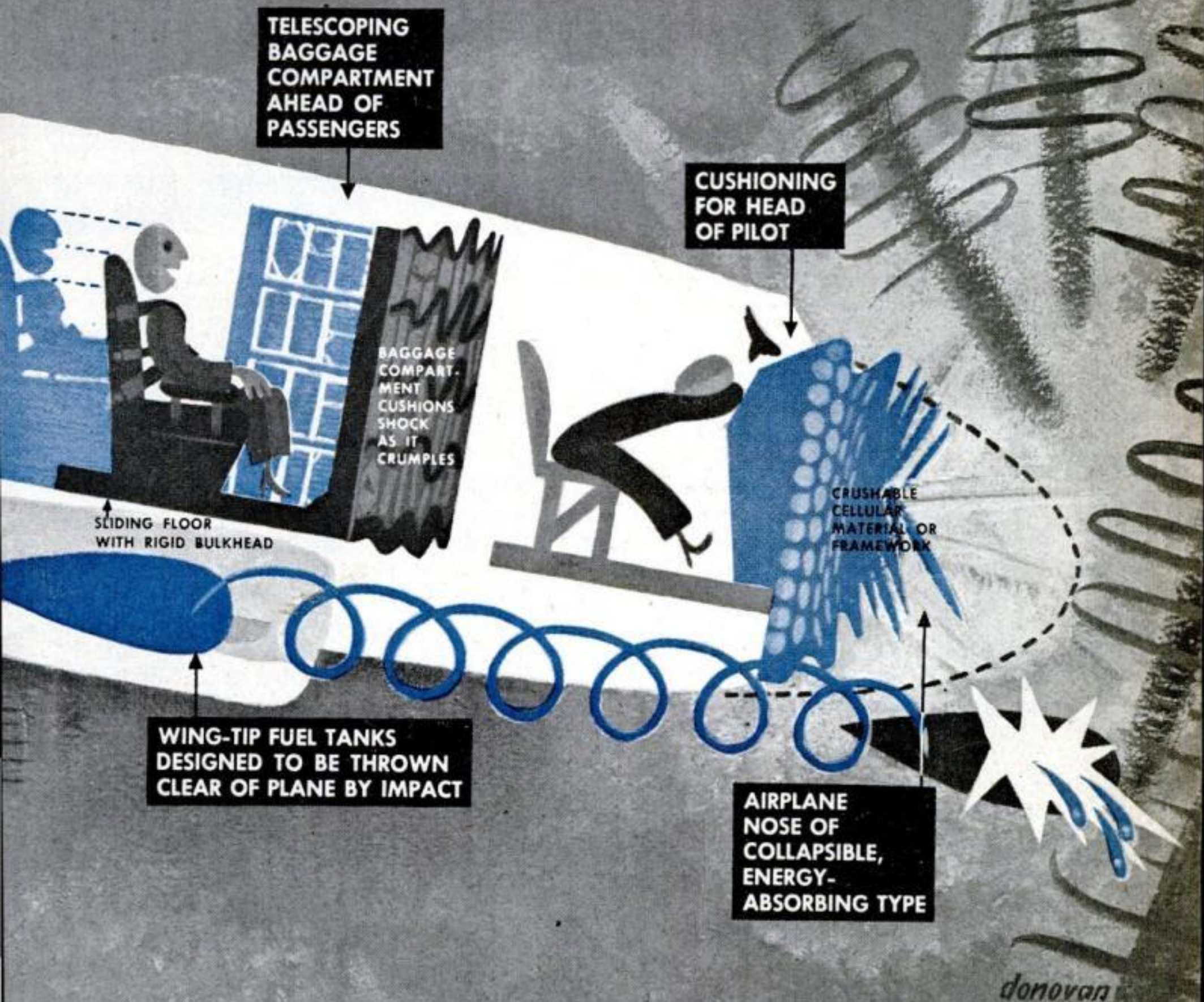
GAS given off by apples makes them ripen fast in storage. This portable fan slows that chemical action, filtering the gas from air in storage rooms by continuously recirculating it through activated carbon. Based on research at Cornell, the air purifier lets a grower hold his crop 4 to 6 weeks longer for a good market price.



Composite drawing shows seven ways to decrease air-crash fatalities, suggested by recent research. Either auxiliary shoulder-high safety straps or passenger seats facing backward avert head injuries caused by pitching forward. Padded headrest gives the pilot similar protection. Collapsible nose of plane

absorbs much of energy of impact. Passenger seats on hydraulic piston and telescoping baggage compartment ahead of cabin are both shock-absorbing possibilities. Wing-tip fuel tanks that break loose and are thrown clear in crash avert burning of plane. Tanks can also be jettisoned if crash looms.

Smashing Eggs To Save Heads



Cornell research in what happens when humans hit may mean safer planes, trains, and cars.

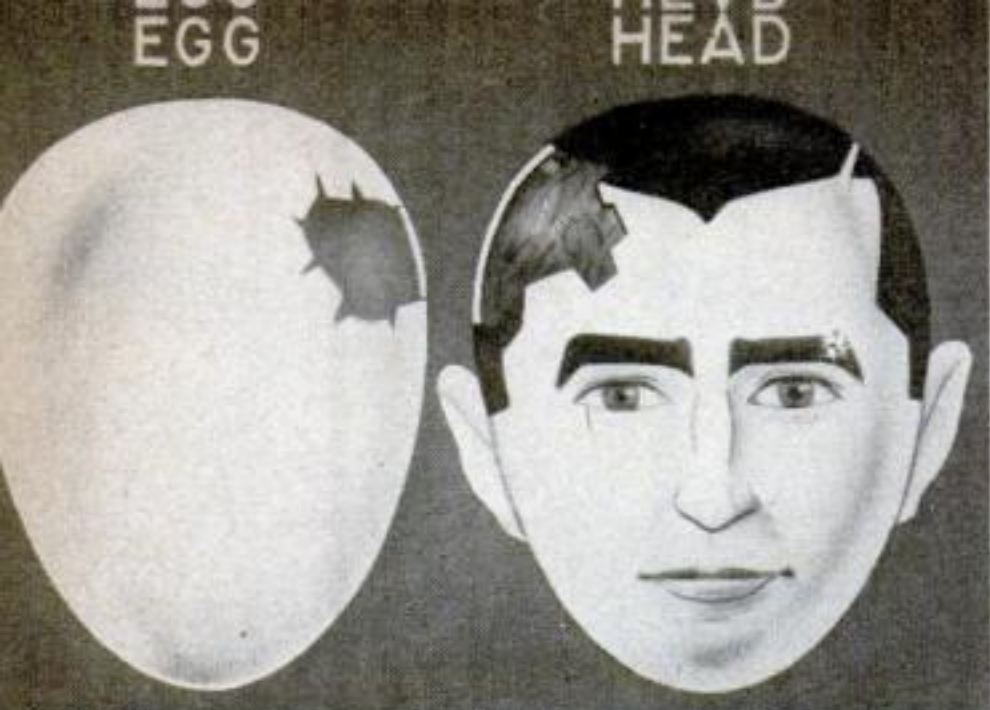
IF DESIGNERS succeed in applying newly discovered principles, they may soon produce an airplane that gives occupants a reasonable chance of surviving a head-on crash at 100 miles an hour or more.

Such a plane would mean as great an advance in safety for air travelers as was brought to railroad passengers when modern steel coaches replaced flimsy wooden ones.

By finding the answers to such curious

questions as what it takes to break an egg, research experts already are planning the features of this supersafety plane. Moreover, they are obtaining new and basic data that may help safeguard passengers in trains, cars, and, in fact, any swiftly moving vehicle.

Under the auspices of the Cornell Committee for Air Safety Research, Hugh De Haven of the Cornell Medical College recently completed an investigation of causes of injury and death in 600 private-plane crashes in which there were survivors. By far the greatest number of fatalities, he found, resulted from head injuries. Pilots



1. An egg, experimenters found, makes a good "working model" of the human head. Both are nearly ellipsoidal in shape, and have a hard but breakable shell and semifluid contents.



2. "Crash carriage" above, suspended like pendulum from ceiling, carries egg between adjustable wooden blocks. To simulate airplane crash, experimenters swung it against the wall.

and passengers who escaped head injury often walked away unscathed, even from planes that were totally demolished!

Preventing head injuries, he concludes, would be a major step in reducing air-crash casualties. And learning how to do it has been the object of a parallel program of research conducted at the Cornell Aeronautical Laboratory, Buffalo, N. Y., under the direction of Dr. Clifford C. Furnas, by researchers using eggs as make-believe heads.

To simulate an airplane crash, they devised a "crash carriage," a small platform suspended like a pendulum from a laboratory ceiling. When swung back and released, it would collide head-on at a known velocity with a solid wall. For each trial, they placed an egg on the carriage between a pair of wooden blocks that could be adjusted by thumbscrews to remain

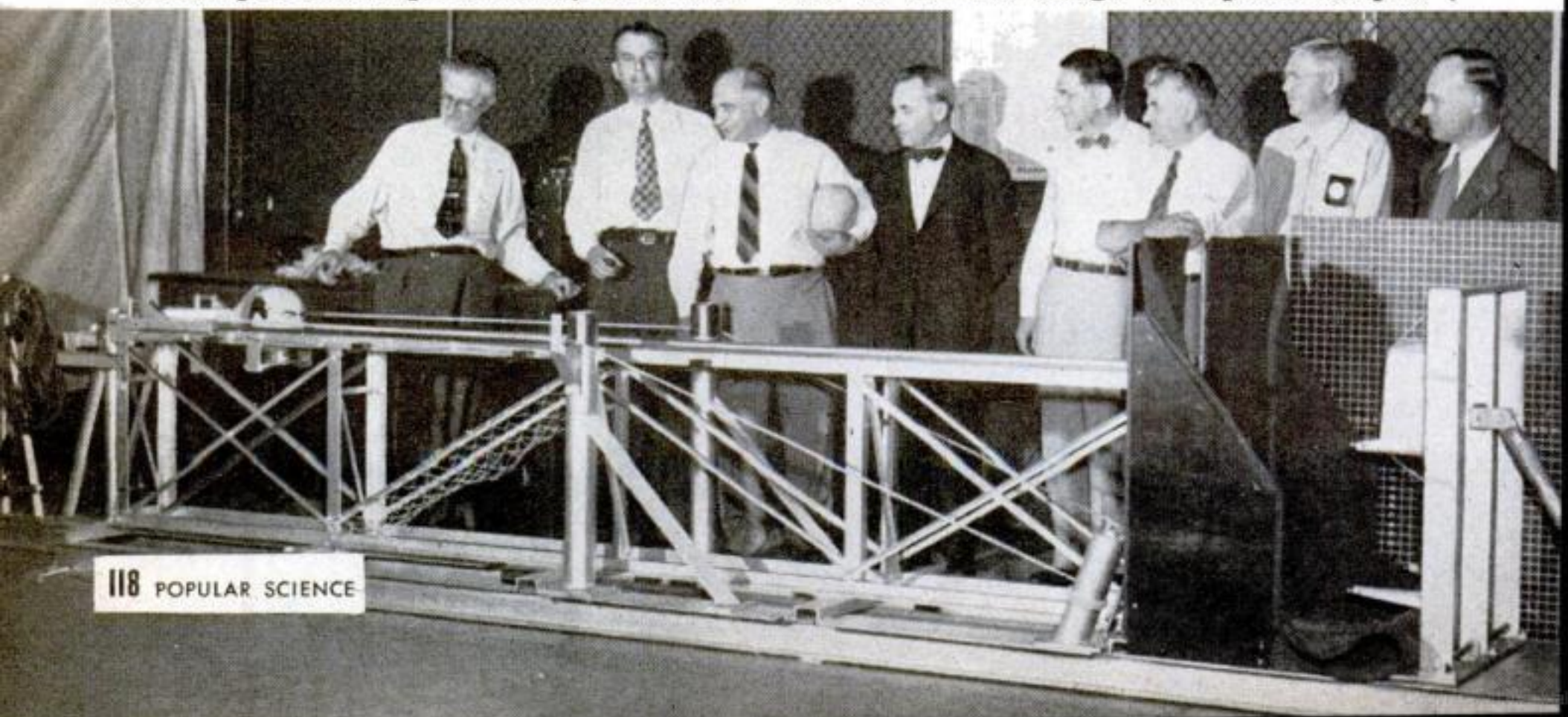
fixed or to yield by sliding upon impact.

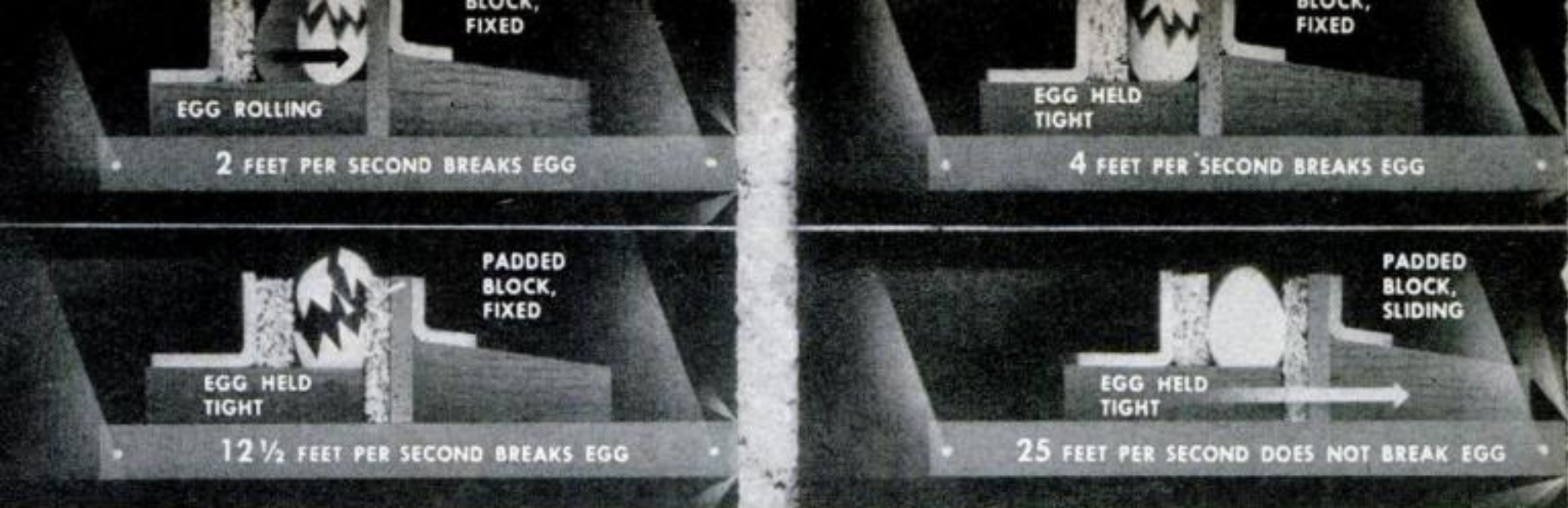
With the blocks arranged so that the egg, at impact, would roll forward one inch and strike a rigid hardwood surface, they found a velocity of only two feet per second enough to break the egg. Similarly, even a moderate impact might crack an air passenger's skull if it threw his head against an unyielding object.

Giving the egg no freedom of movement doubled the velocity required to break it, and adding a sponge-rubber pad between the egg and the surface it struck boosted the needed velocity to 12½ feet per second. To apply this advantage in a plane, passenger seats could face backward so that their padding would cushion an occupant thrown forward by a crash. If riding backward didn't appeal to the public, auxiliary shoulder-high safety straps for use when a

4. Life-size "head form" resembling human head, a 9½-pound plastic shell filled with gelatinous mixture, is hurled against test objects at velocities up to 150 feet per second by shock-cord

catapult below. This current "head impact investigation" for the Office of Naval Research at Cornell Aeronautical Laboratory, seeks detailed data on the safe design of airplane cockpits.





3. Impact of carriage at only two feet per second broke an egg left free to roll against unyielding hardwood block. But when egg rested against yielding rubber-padded block, it sur-

vived 25-foot-per-second impact, corresponding to force on nose of plane hitting ground at 385 m.p.h. and stopping in five feet! Proposed safety measures would apply these findings.

crash looms would prevent bashed-in heads.

In a variation of the last test, the experimenters adjusted the padded block to yield by sliding forward 10 inches, against appreciable friction, upon impact. Then the egg remained unbroken at a velocity of 25 feet per second, or in a crash with about 155 times the energy of the first.

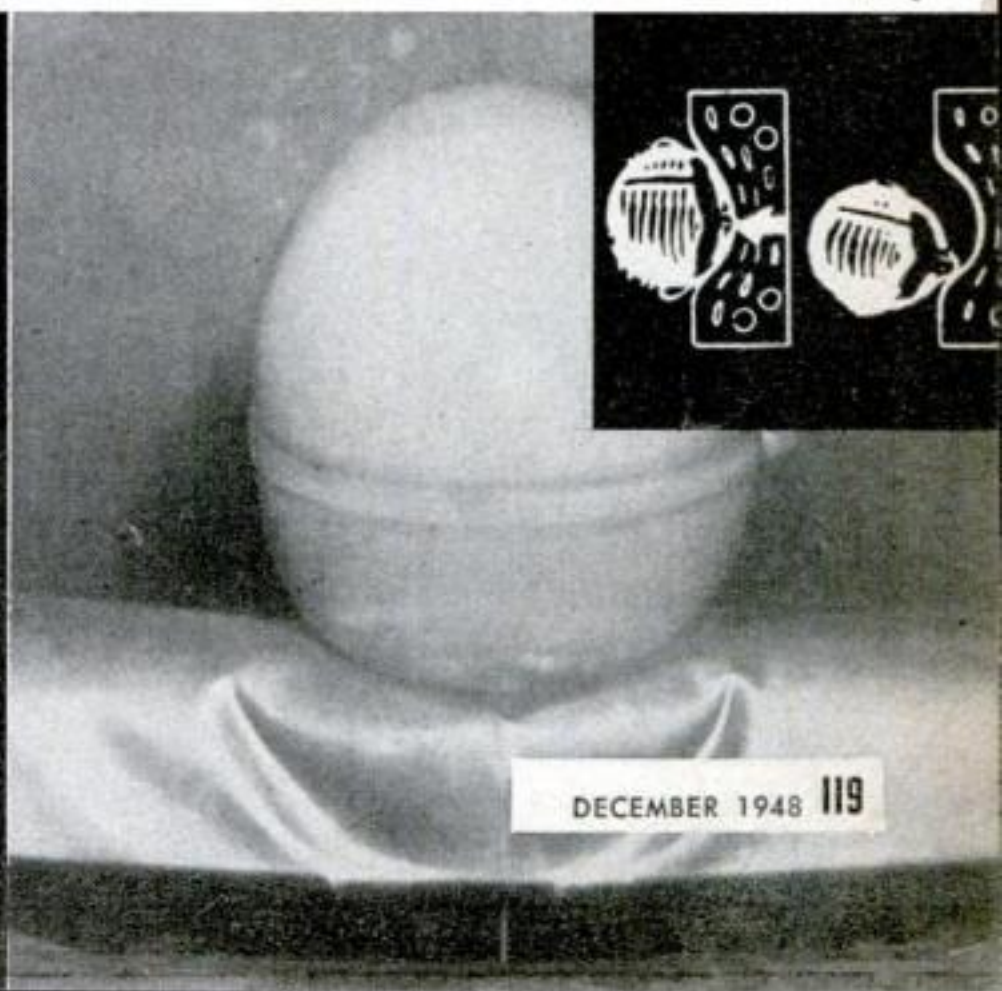
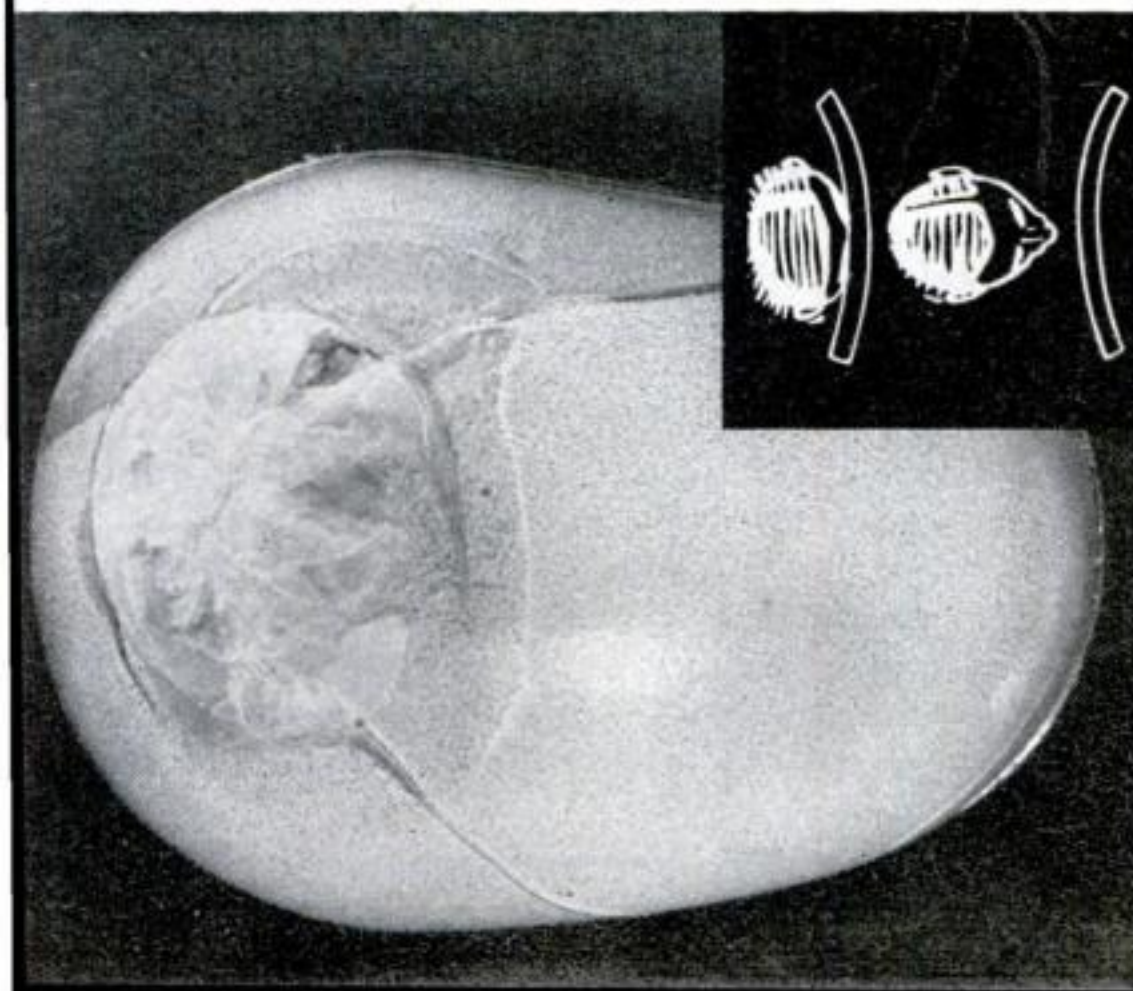
To obtain some of the benefit of the principle thus demonstrated, passenger seats might be mounted on a piston that would move forward, in a crash, into a shock-absorbing hydraulic cylinder. An alternative scheme would provide a telescoping baggage compartment *ahead* of the passenger cabin, which could slide forward into it—with squashed luggage, perhaps, the only casualty! But above all, a special collapsible nose for a plane—containing any energy-absorbing material, even empty beer cans or

oil drums—would absorb much of the impact.

To obtain detailed engineering data on designing airplane cockpits for safety, the Cornell Aeronautical Laboratory is now conducting further tests for the Office of Naval Research. These employ life-size, 9½-lb. “head forms” made of plastic, filled with a gelatinous mixture, and designed to break under approximately the same forces that would fracture a human skull. A catapult powered by elastic shock cords hurls these head models at various test objects at speeds up to 150 feet per second. No model has yet broken against an experimental cockpit panel of thin, easily dented metal backed by crushable, lightweight cellular material—the best combination found to date for cushioning a blow and avoiding elastic rebound that bounces the head against other dangerous objects. END

5. Cracked “head form” shows hazard of ordinary ⅛-in.-thick metal panel in cockpit. Airman’s head striking it gets damaging blow and is then thrown backward by its rebound (inset).

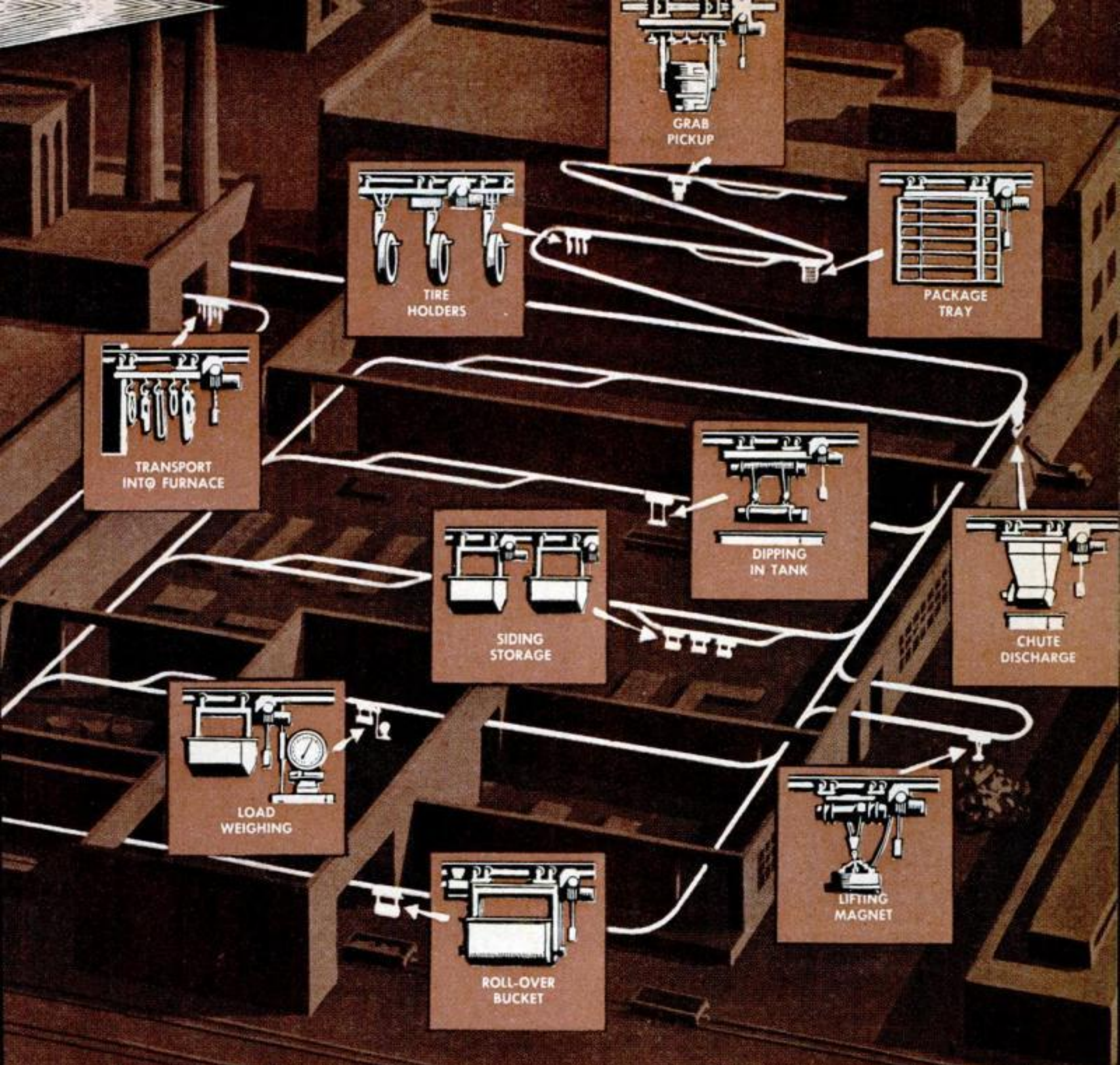
6. Intact after high-velocity impact, another “head form” demonstrates safety of an experimental cockpit panel (inset) with easily dented thin-metal surface and crushable cellular filling.





Mechanical Muscles

Pressing buttons on the magic control box, at left, sends this monorail materials carrier on its way, "telling" the motor unit, at top left, where to go and what to do en route. Cutaway of a factory graphically illustrates types of equipment used and some of the many jobs that can be preset in the Louden Selectomatic[®] Dispatch System for automatic, "no-hands" compliance. The pendant control box will take 1,260 combinations of routing, operations, and destination.



Are Stronger and Quicker

In industry, where every day is moving day, new machines are solving the problem of handling materials.

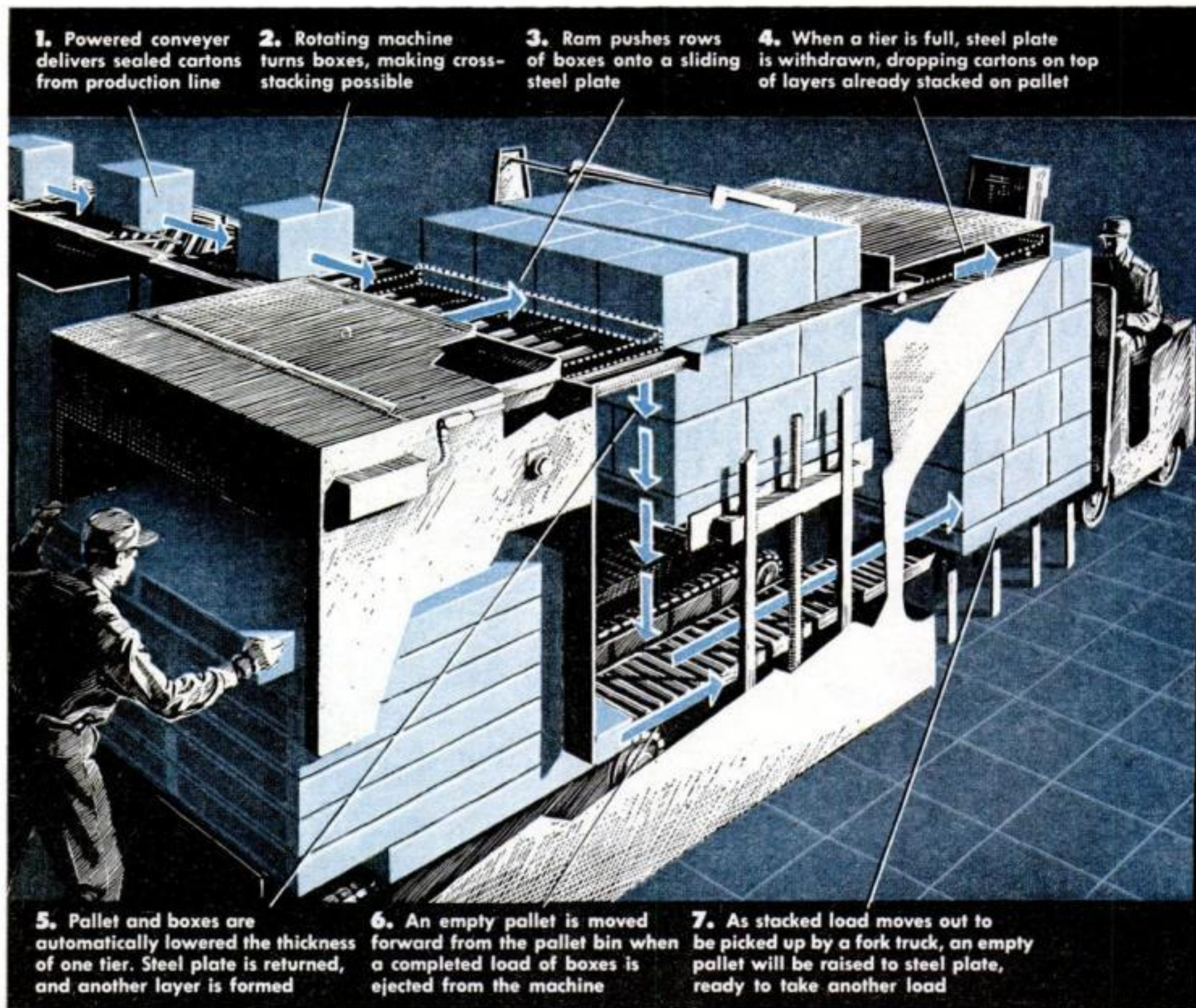
By Herbert Johansen

Drawings by Ray Pioch

EVERY time you push a basket in a supermarket, or use a shovel or wheelbarrow, you are solving a problem in "ma-

terials handling." For materials handling is just industry's name for collecting and carrying the pieces that make products.

Scientific materials handling, however, is something new. It came of age in the rush of the war—the biggest moving job in history. So, today, a large variety of industrial trucks, conveyers, cranes, and hoists are replacing the old "hernia method." Latest miracle of mechanical ingenuity, shown above, is a super



The Automatic Pallet Loader®, shown in artist's sketch above, bridges one of the last gaps in unit-load materials handling. With a capacity

up to 1,500 cartons an hour, the machine automatically cross-stacks to a predetermined pattern, forming an interlocked and uniform load.

monorail system that does a score of delivery jobs at the push of a button. But before describing the antics of this fantastic robot, let's look into the simpler forms of materials handling.

The real workhorses are the industrial trucks. Have you ever stepped aside for a motorized baggage cart clanging down a station platform? That's an early, primitive form of industrial truck. Today there are dozens of types designed for specific jobs. Most versatile is the fork lift truck, used in combination with pallets—low platforms that are really portable floors for handling loose materials or many items stacked to make single loads.

Suppose your week-end shopping at the local market amounts to several dozen assorted cans, boxes, and other loose items.

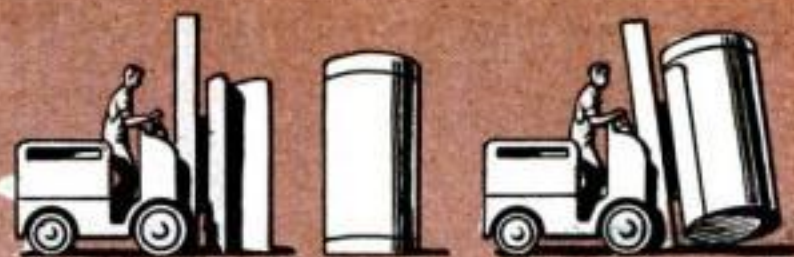
The clerk piles them on the counter—but, he is sorry, he has no carton or bags in which to put them. You'll probably make four or five trips to load them into your car. The carton or paper bag is basic to the unit loading of your groceries (with your extended arms serving as the prongs of a fork truck).

In the same way the pallet is basic to unit handling of materials in industry.

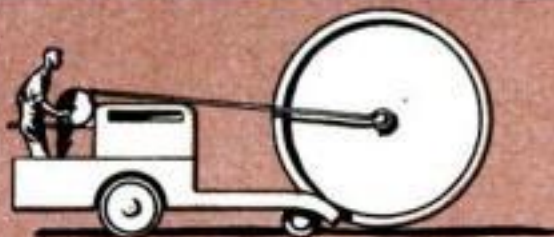
Fork Truck Cradles Pallet on Arms

The fork truck, either electrically or gasoline operated, has two prongs or arms extending out in front. These are driven under the loaded pallet. The forks are then raised a few inches, lifting pallet and all for easy horizontal travel to stock pile or freight car.

For stacking, some of these trucks can boost their loads to a height of ten feet or



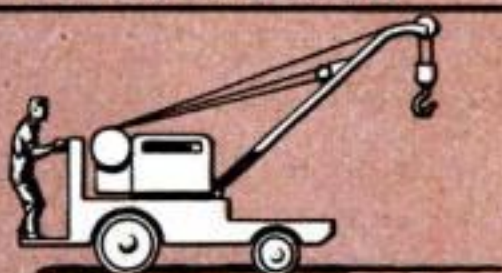
ROLL HANDLER



REEL HANDLER



RAM ATTACHMENT



MOBILE CRANE

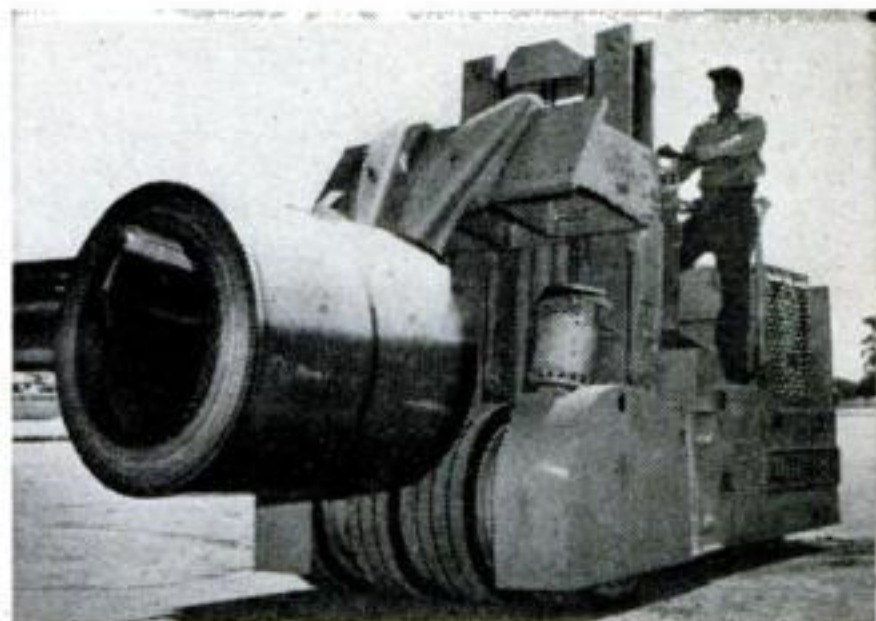


JOINTED SHEET HANDLER

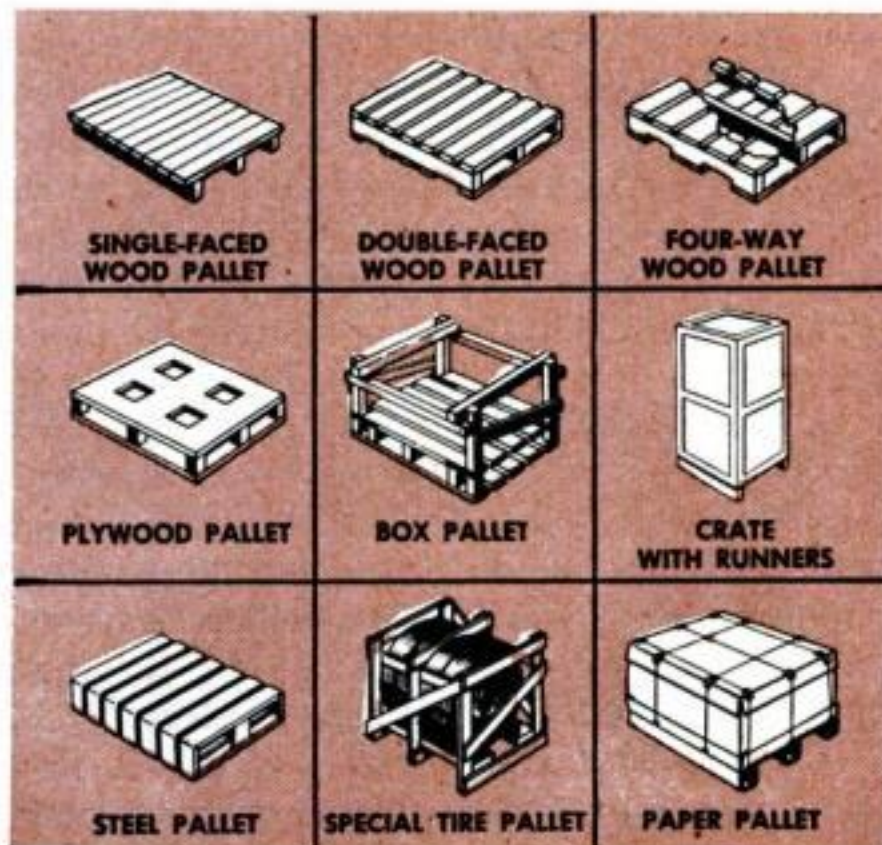
Industrial trucks are designed for many special materials-handling jobs. The sketches above show only a few of those now in common use.



The high-lift fork truck pictured above is basic to the unit-load handling of materials.



This Skylift Giant[®] is the heavyweight of industrial trucks. With either ram or fork attachment, it can handle loads up to 30 tons.

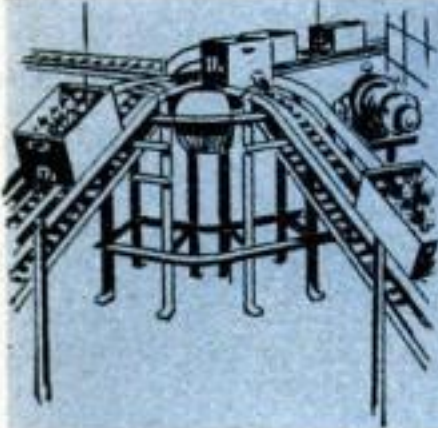


Pallets come in many types, but must be light in weight while able to sustain heavy loads.



The Chuckaway[®], a cardboard pallet (inset), is disposable, but it can support heavy loads.

CONVEYERS SOLVE MANY PROBLEMS IN THE HANDLING OF MATERIALS



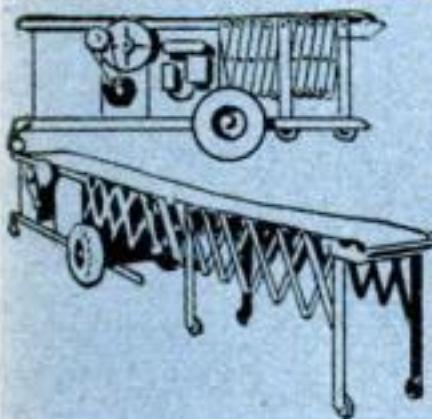
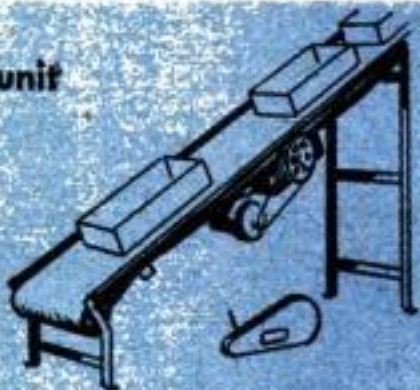
Held by "shoes," heavy cases get a boost up steep incline on this conveyer. At control point on top, switch gates permit shunting of cases to various parts of warehouse.

The utility conveyer is ideal for package loading and storage. Most types are portable and reversible. It is easy to handle but is not suitable for heavy loads.



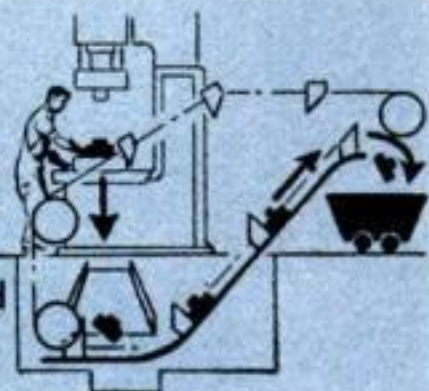
The power-driven slat conveyer can handle heavy crate or box-type loads. Best suited for moving a continuous flow of material over set route.

Here a Handi-Drive[®] unit has been added to power an inclined belt conveyer. It can be used to convert almost any type of gravity or roller-conveyer system to power.



The Extend-O-Veyor[®] is a new type of portable belt conveyer that goes to the job. Extended it reaches 46 feet. Closed it can be moved easily in confined areas.

This special Lamson pusher-type chain conveyer enables one man to do the work of two. Forgings dropped from machine are pushed up and dumped into waiting trucks.



more. This makes it possible to stack right up to the ceiling, using "the forgotten half" of a factory or warehouse—the "air rights" over your head.

Industrial trucks are undoubtedly the greatest single factor in cutting the cost of putting materials in motion. Hand trucks, under the best conditions, can move half a ton about 100 feet a minute. Powered trucks take loads of five tons and more and travel three to five times as fast.

The main advantage of pallets is that they are light in weight and take up little space themselves in stacking unit loads on top of one another. Their price—metal, wood, or a combination of both cost between \$3 and \$10—is a big disadvantage in shipping. They are too valuable to be thrown away and must be returned at regular freight rates. This too often cancels the savings gained by using pallets.

Disposable Pallet Is the Answer

One answer is the paper pallet—strong enough to support a heavy load, yet cheap enough to be thrown away at the other end. Such pallets, made of kraft paper, can be produced at a cost of between 42¢ and \$1.00. Large cartons are also being made with a built-in pallet on the bottom.

Latest entry in this field is the expendable pallet made by the Chuckaway Co., of Boston. It is 40 inches by 48 inches, and weighs only six pounds, compared to 100 pounds for wooden pallets. In a recent shipment by water from the East Coast to the West Coast, each of the pallets carried a load of 2,000 pounds, and arrived at the destination in perfect condition.

The strength of these Chuckaway[®] pallets is in nine spiral-wound paperboard tubes. Five inches in diameter, these tubes are stuck to a corrugated paperboard platform with a special adhesive. The whole unit is chemically treated to make it moistureproof.

Until recently there was a missing link in the unit-movement of materials: the separate items or packages had to be loaded on the pallet by hand in the first step. Now along comes the Automatic Pallet Loader[®], developed by Production Aids, of California, and distributed by the Lamson Corp.

Cartons and cases flow directly from a conveyor into the machine, which loads them on an empty pallet in a predetermined stacking arrangement. When the pallet is full, it is shoved out, ready to be picked up

by a fork truck, and another empty pallet pops up into place. An electric control unit permits you to select up to 18 stacking arrangements by simply pushing a button.

The conveyers that feed the Pallet Loader play many other important roles in materials handling, such as moving large quantities of goods continuously over fixed routes. The simplest of these is the inclined, one-way gravity conveyer. Many years ago, the founder of one of the largest manufacturers in this field added power to a conveyer of this type in a unique way. As the keeper of a New England notions store in 1880, he sawed croquet balls in two, hollowed them out and rolled them in wooden troughs from the sales counter to the cashier's desk.

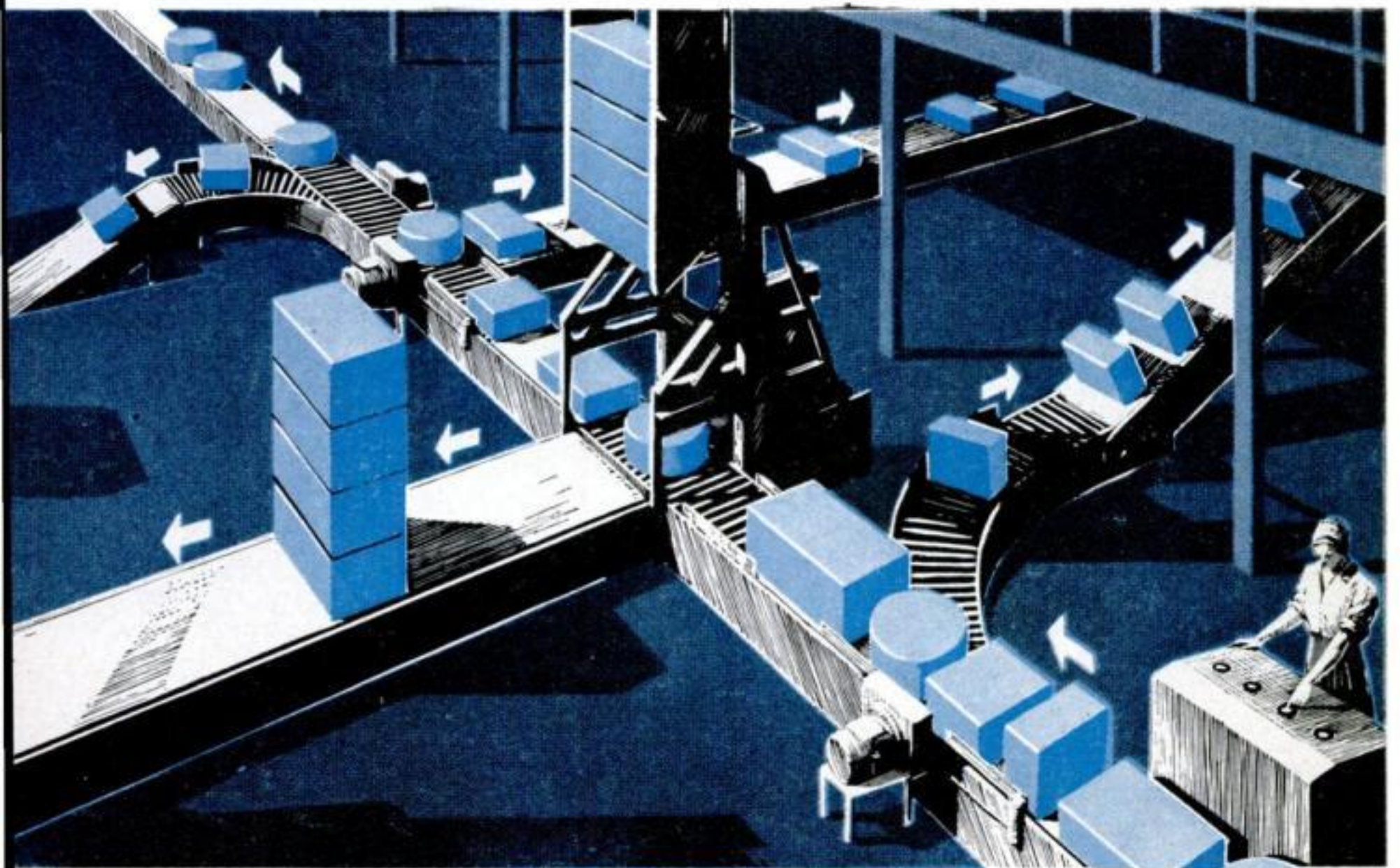
Gravity conveyers still fill a need, especially in moving goods between floors, but today powered conveyers are carrying more and more loads. There are chain, roller, slat, belt, and overhead conveyers. One important job they do is pacing work: the speed and volume of material traveling along these factory highways can be regulated so as to coordinate the operations of an entire plant.

Portable powered conveyers are the jacks-



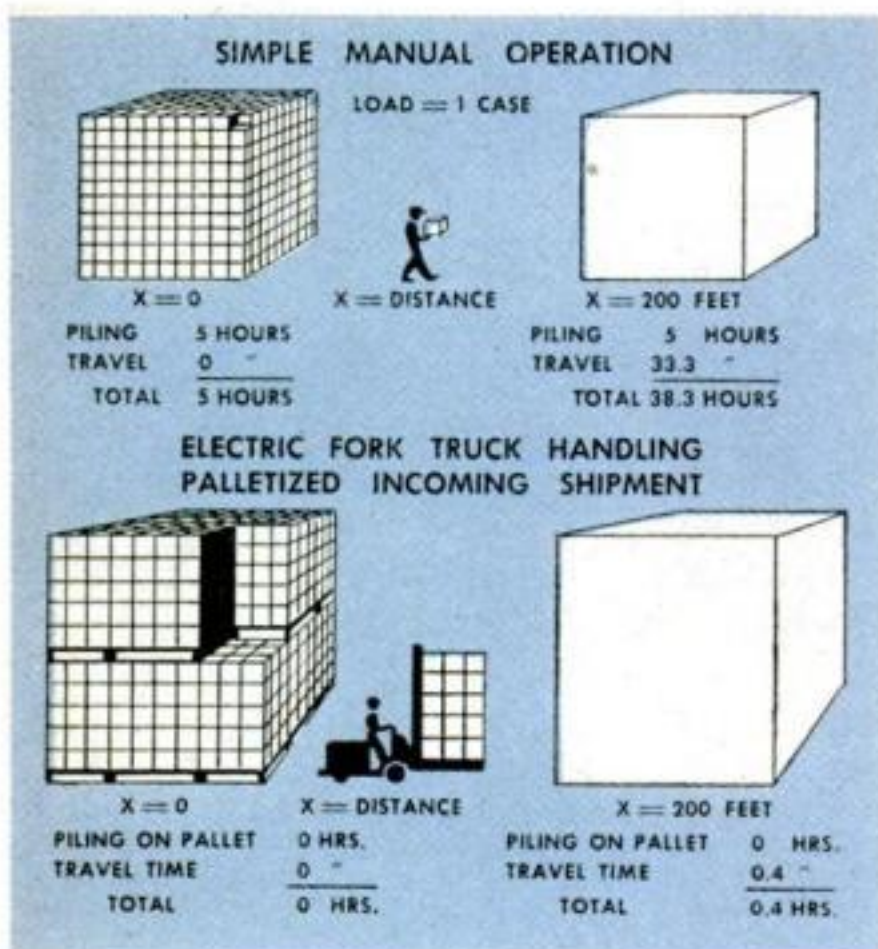
The powered hand truck is useful in confined places and for loading and unloading boxcars.

of-all-trades. For stacking self-contained units such as bags and bales, for loading across short distances into freight cars, trucks, and airplane cargo holds, they rival the lift truck. In a series, they can maintain a flow of material going around corners. But even with special extensions provided on many new models, they are no competition for the industrial truck in mov-



An artist's conception of how an FMC Segregator® can sort containers into five different classifications. The operator at lower right

makes a visual selection, presses the proper button. The containers then travel along the conveyor to the predetermined floor or storage area.



ing materials more than a few dozen feet.

Overhead conveyers are another way of taking advantage of the "air rights" to a factory. They range from huge, heavy-duty traveling cranes to simple movable hooks on which material is hung. Most common is a unit rolling on trolleys along an overhead monorail. It may be pulled by an operator on the floor; electrically operated, it can be controlled either by an operator in an overhead moving cab or self-powered as an endless-chain operation.

One of the latest developments for use in conjunction with powered conveyers is a selector system made by the Food Machinery Corp., of Riverside, Calif. It was designed originally for sorting boxes of lemons by color, a measure of the fruit's maturity. The problem was to pull out boxes of ripe yellow fruit for immediate shipment, and then divert other boxes, according to color or degree of ripeness, to their proper location in the warehouse for further ripening.

The job is done by an operator stationed at a control box near the receiving end of the conveyer. As each box passes his station, the operator makes a visual selection. He touches a button to send the box along a route to its proper destination. This FMC Automatic Segregator® is now being adapted for many other industrial uses.

The "believe-it-or-not" of materials handling, however, is the overhead monorail conveyer system developed by the Loudon Machinery Co., of Fairfield, Iowa, and illustrated on the opening pages of this article.

The "brain" that actuates its multifarious control functions is in the Selectomatic® box dangling from the overhead tractor unit or locomotive.

A model-railroad fan would have a lot of fun playing these buttons. "Trains" can be routed by preset schedules. Loads can be picked up and dropped. Several trains can be routed and switched over specified tracks. They can be made to stop and start at stations. Block signals prevent collisions.

The material to be handled can be carried in buckets, hung on hoists or hooks, placed in racks attached to the motor unit, or suspended from an electromagnet. The operator at the originating point decides where he wants the load to end up in a plant and what he wants it to do en route. He then presets this sequence in the pendant Selectomatic control box, and pushes the starter button. From then on the operation is strictly "no hands."

1,260 Jobs in a Box

The three switches in the selector box can handle 1,260 possible combinations of routing and destination. Control collectors, attached to the overhead motor unit, come in contact with insulated sections of the power track, closing electric circuits that perform the functions preset in the magic box.

Once this is set, the unit transports material along the shortest and most direct route. It travels from floor to floor, building to building. It opens doors—oven doors, floor doors, building doors—and closes them after going through. It dips loads into baths or vats, times the immersion, and resumes travel. It trundles loads into ovens or through tunnels of infrared drier lamps, turning the heat or lights on and off as needed. It weighs its own loads. It stops on a dime at its destination, and then returns empty carriers to the point of origin.

Materials handling has been a challenge since man was first faced with the problem of transporting his kill back to the home cave. Heavy loads, because of their great tonnage, have forced their own mechanical handling solution. It is the lighter loads and small items, from raw materials to finished products, that are still too often moved by brawn instead of brain. It may not be wise to put all your eggs in one basket, but it is certainly common sense to pack them in cardboard cartons. Have you ever tried carrying a dozen Grade A's loose? **END**



Fire Suit Reflects Heat

You could wrap a lot of chewing gum and cigarettes in the metal foil used in one of the Air Force's new fire-fighting suits. Made entirely of aluminum foil laminated to a cotton backing, it is designed to keep its wearer cool by reflecting heat.

In the photo at left above, showing a recent test, note that the man wearing the

older-type cotton suit (center) has become overheated and is being hosed down. The man to his left in the new suit, however, is not bothered by the intense heat.

Newest version of the suit, shown at right, weighs under 8 lb., and has a tight-fitting hood in place of the loose, heat-leaky one at left. The glass window will stand 2,000° F. and a 2,000-lb. shock. Glass fabric is to be substituted for the cotton backing.

Mask 'Breathes' Oxygen

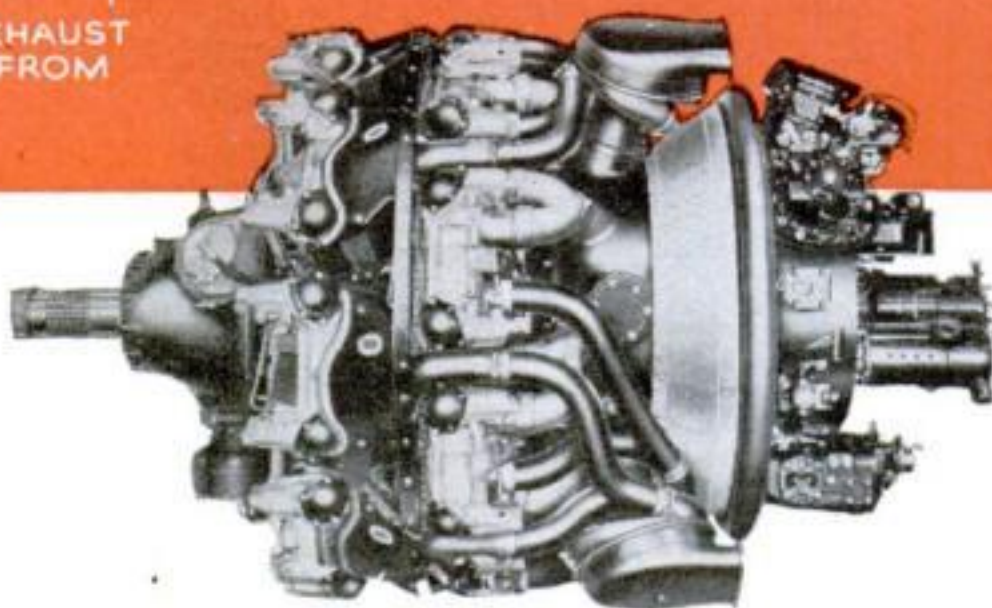
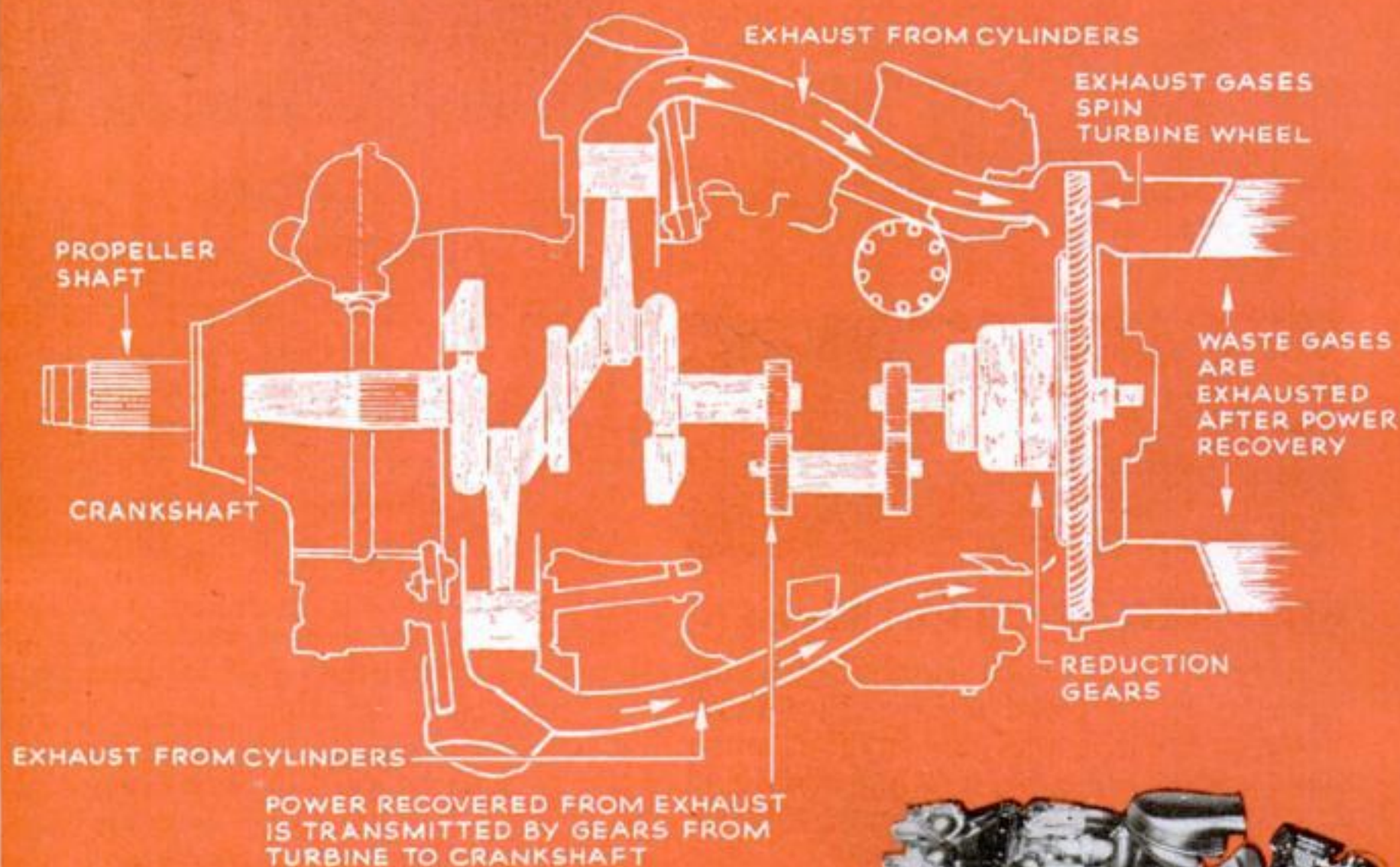
FIRE fighters working in dense smoke and poisonous fumes no longer need to carry a heavy, cumbersome tank to supply oxygen. With this "self-breathing" Chemox[®] mask, they can generate their own oxygen.

The face mask is connected to a small, flat chest pack containing a canister of potassium tetraoxide. When the wearer exhales, moisture from his breath starts a chemical reaction that liberates oxygen and also absorbs the waste carbon dioxide.

Each canister gives about 45 minutes of oxygen and can be quickly replaced with a fresh one. A bell rings when the supply is low. The dry oxygen won't fog the mask's goggles, as will compressed oxygen. The 13½-pound mask was used by the Navy during the war and has just been adopted by the Pittsburgh Fire Department.



Waste Makes Power



Side view of the new Wright Turbo-Cyclone 18 Compound engine. Increasing range of planes by 20 percent, it will be built for U.S. Navy.

An aeronautical engineer's drawing shows the principle of capturing the energy of exhaust gases via a turbine to gain extra power.

THE reciprocal aircraft engine has taken a free ride on the turbine wheel. The power now wastefully spewed out in its exhaust has been harnessed and put to work on the crankshaft—adding power, range, and payload.

This revolutionary development, called compounding, will add more than 1,000 miles to the range of our big bombers, and may increase the passenger capacity of our commercial air liners by as much as 50 percent. *And all this uses no extra fuel nor adds any appreciable weight to the airplane.*

Capturing wasted exhaust energy and making it do useful work is not new. The turbosupercharger was pioneered in World War I, and was responsible for the high-altitude performance of our combat planes

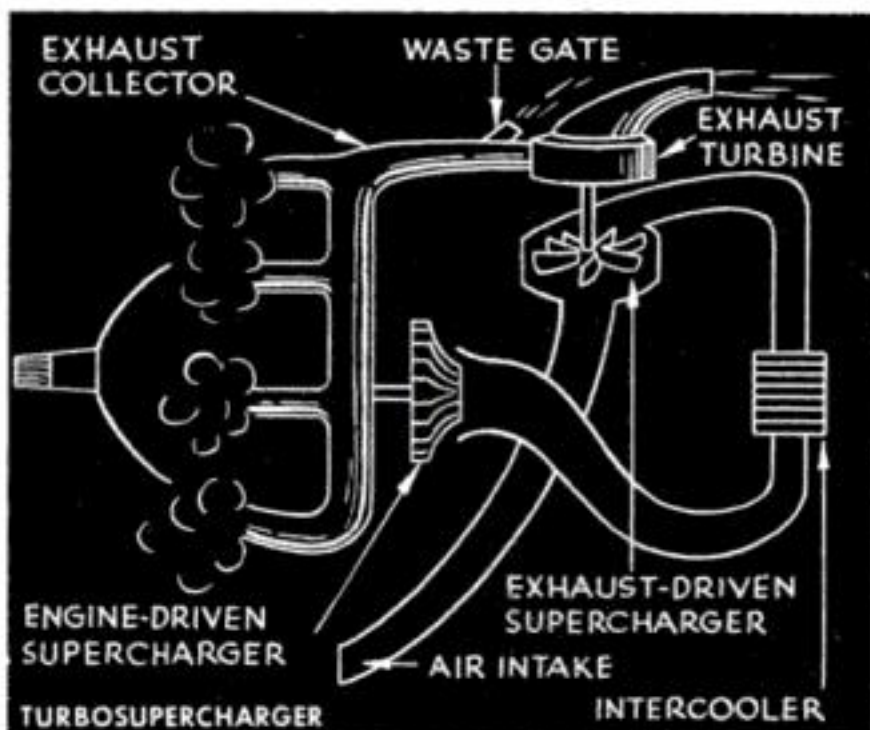
in World War II. This device provides sea-level atmosphere to the engine at high altitudes, so that it can operate at sea-level power in the upper atmosphere. It is not true compounding, however, as there is no direct connection with the engine crankshaft. It neither increases take-off power nor reduces fuel consumption.

The exhaust can also be put to work by using it as a thrusting jet. In its simplest form this can be done by installing a series

of stacks designed to make the exhaust push the plane like a jet. This device is useful at high speeds, but the increase in thrust is so small that it does not justify the added weight of the stacks for long-range military or commercial aircraft.

Engineers had to seek a better way to salvage exhaust energy. With this lost power representing 50 percent of the energy contained in the fuel, the mechanical conversion of wasted exhaust energy into direct propeller-shaft horsepower became a top priority project.

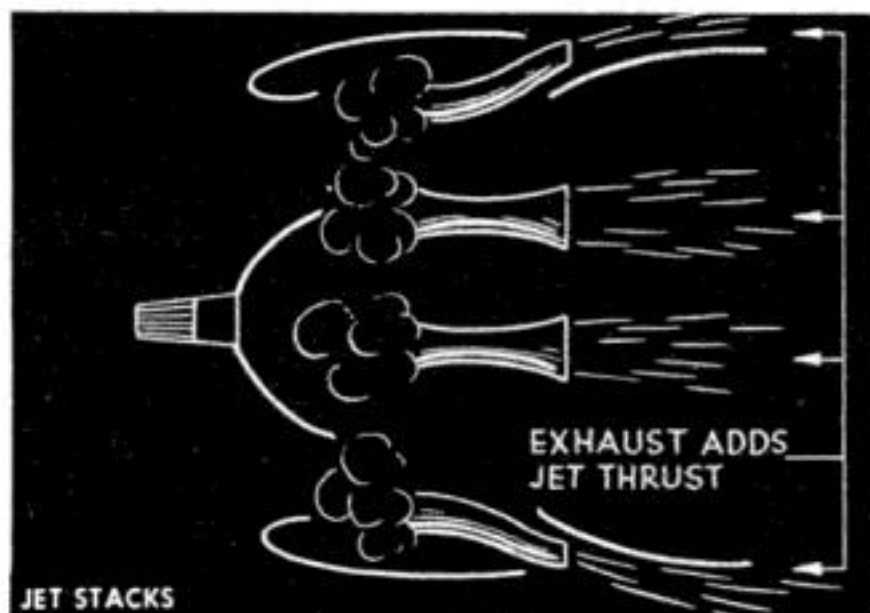
Pressure turbines were one method tried. Such a turbine is fed by an exhaust collector connected to all the cylinders and



geared to the crankshaft. But the exhaust must first be slowed down in the collector at relatively high pressure and then discharged through the turbine at high velocity. And this high pressure, needed to provide energy for the turbine, sets up considerable back pressure. This has the same bad effect on engine performance as a conventional muffler.

But now a third method has arrived—and rung the bell. Probably the best recovery system for long-range bombers and transports, it is known as the “blow-down” or exhaust-turbine method of compounding. Exhaust gases are fed individually from each stack at only a slight increase in pressure over the back pressure encountered in discharging into the atmosphere.

This system has proved so successful in experimental tests that two of the largest aircraft-engine companies have put power plants using it into production. The Navy recently awarded a \$32,000,000 contract for one such engine, the Wright Turbo-

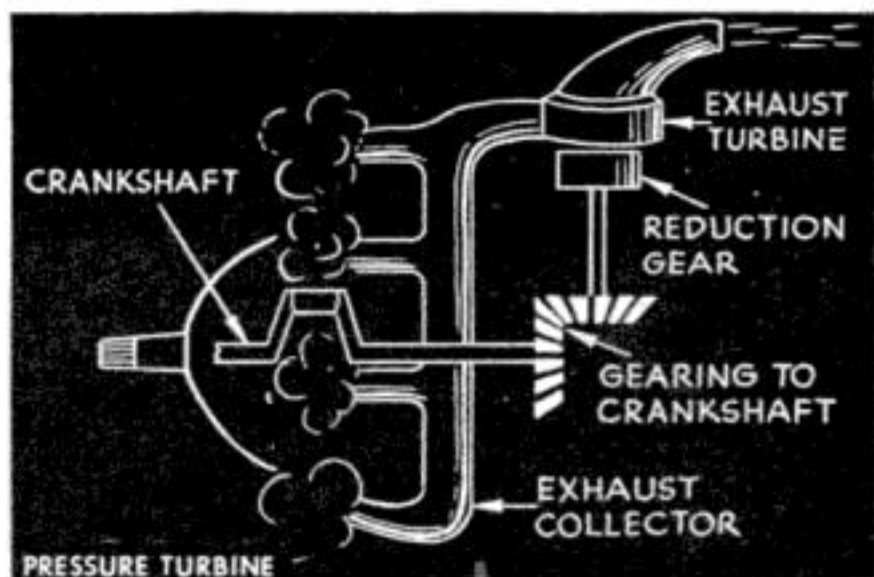


Cyclone 18 Compound. It combines a conventional reciprocating power plant with three “blow-down” or velocity turbines.

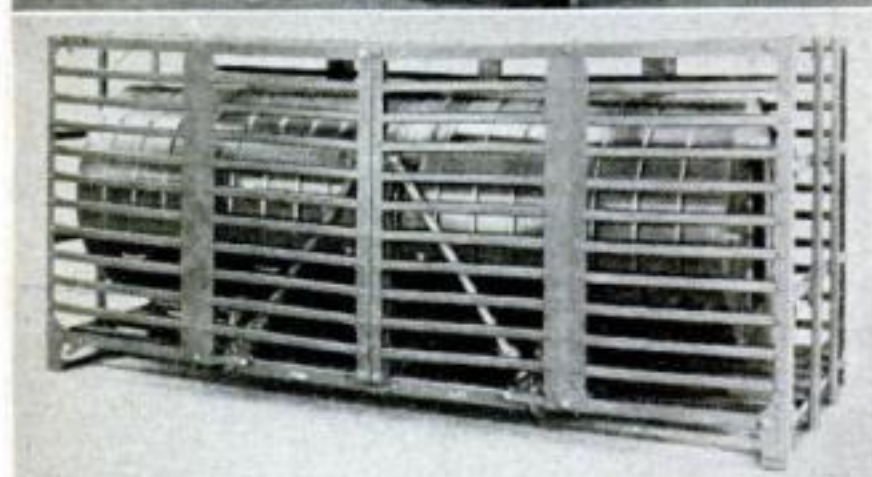
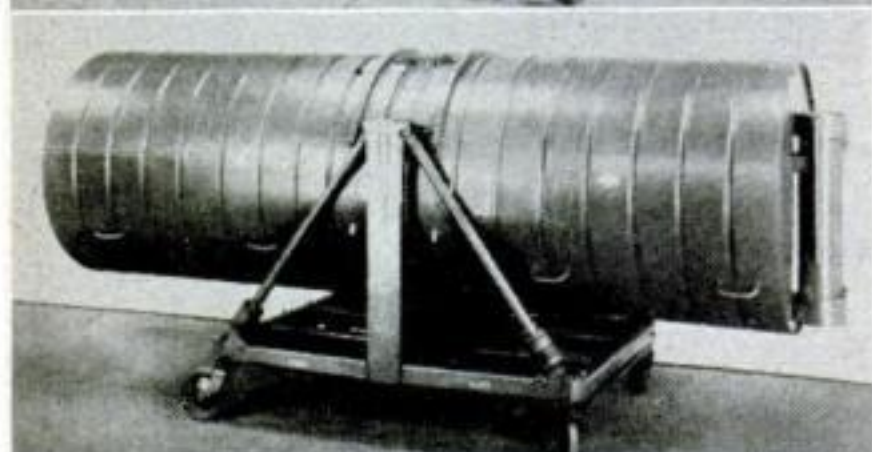
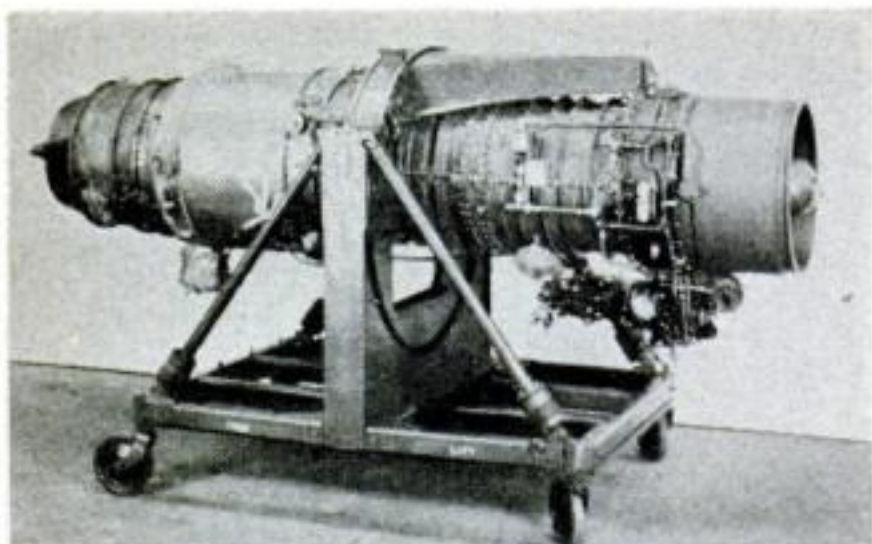
Tests conducted by the Wright company indicate that with the new engine an aircraft can either increase its range 20 percent with the same fuel consumption, or fly the same distance with 20 percent less fuel. Over great distances, where the fuel load can amount to $2\frac{1}{2}$ times the payload, this fuel saving would mean that 50 percent more payload could be carried.

Let us see how it would work out on a ten-hour flight of a standard four-engine air liner. With the compound engine, there would be a reduction of 3,600 pounds in fuel as against an increase of 2,000 pounds in equipment. This gain of 1,600 pounds equals an added capacity of half a dozen passengers or a range increase of more than 200 miles. An extra dividend is that engine noises are sharply reduced.

Although engineers who developed the



new engine are cautious in predicting a wider application, they do say that “its design may be used in developing other power plants.” There is no reason why it should not lead to a more economical automobile engine of tomorrow. **END**



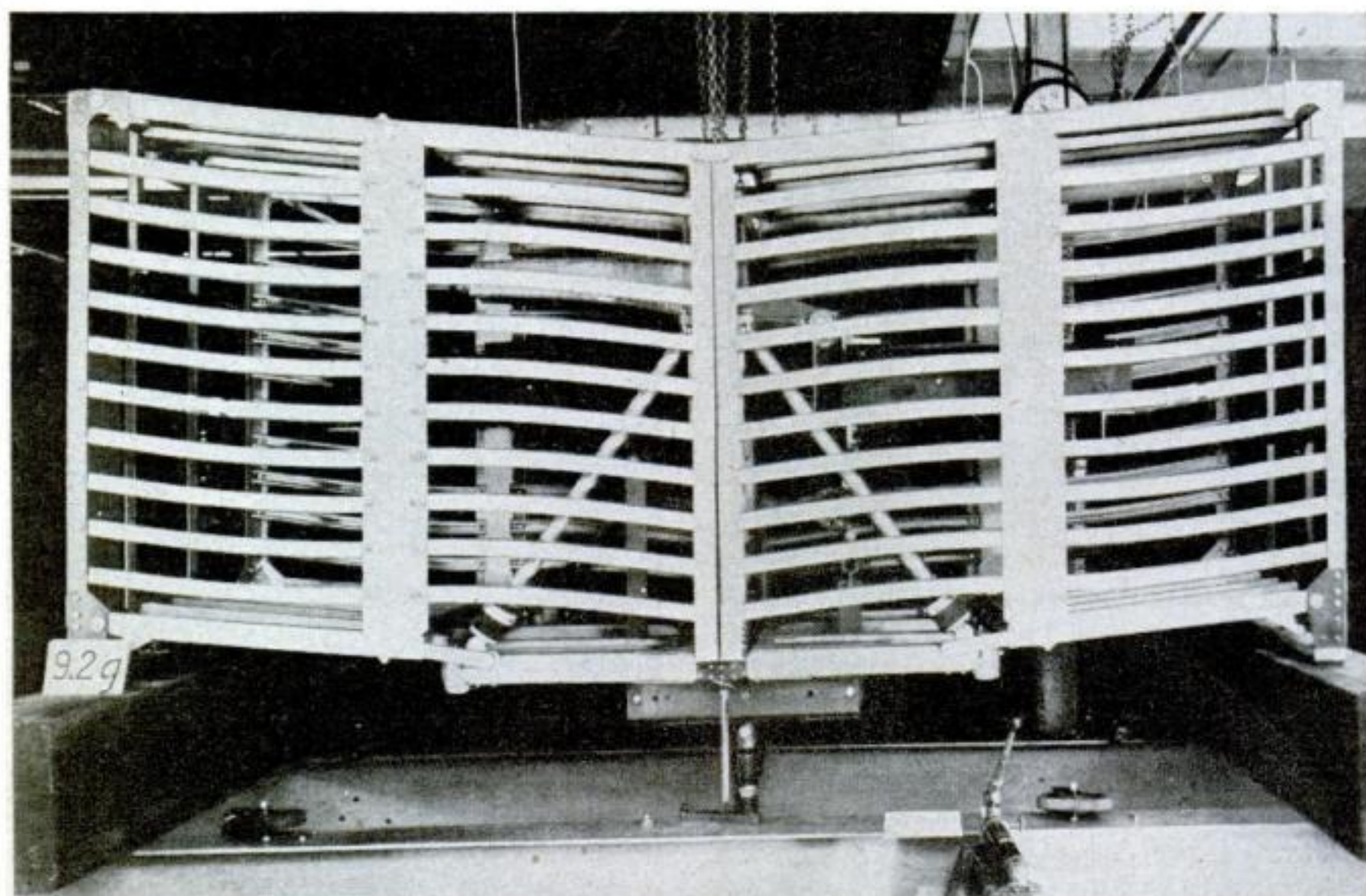
Springs in Crate Spare Jets Bumps

JET engines should survive even a rough landing from an LST when packed in a new crate developed for the Navy by the Edo Corp. In one test, the new container was rolled down a six-foot-high track. The crate sustained an impact 47 times its weight, but the engine inside was bumped by a force only about eight times its weight.

The unique container has three sections. The engine is mounted first on a wheeled stand; then a moisture-proof can is bolted around the power unit to protect it from atmospheric changes. The stand hangs from the center of a cage made up of aluminum leaf springs, so that bumps are almost entirely absorbed by the crate's flexible sides.

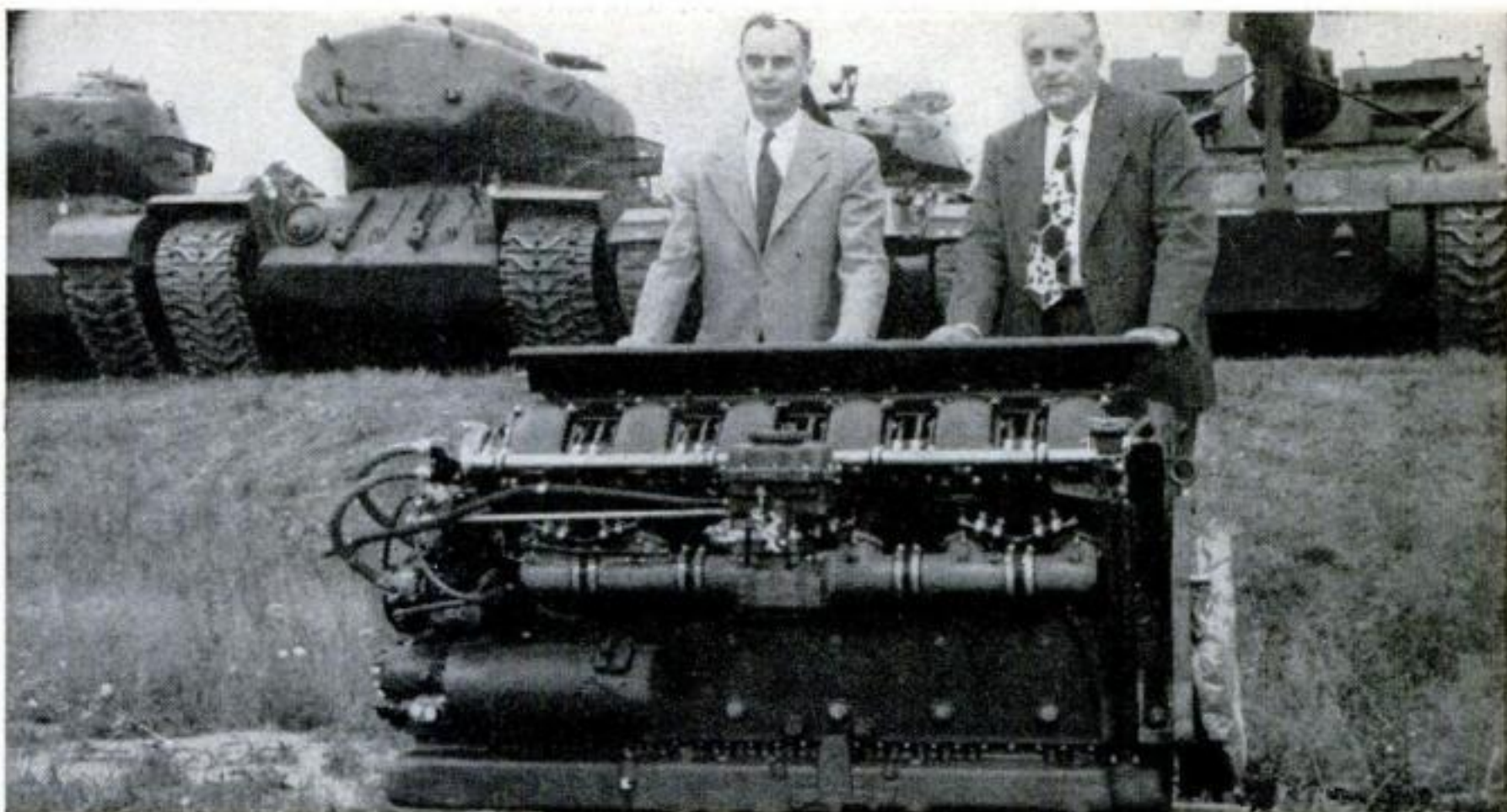
While designed for jet engines, the crate may be used to pack other delicate machines.

Three parts of new engine crate are shown in photos at left. Wheeled stand (top) supports the engine on shock struts, can also be used for repairs and test runs. Aluminum cans (center) are added to keep out moisture. Then stand is hung inside flexible aluminum crate (bottom).



Ability of aluminum cage to absorb shocks that might damage engine is demonstrated by

adding load equivalent to nine times its weight (above). Sides bend like leaf springs on auto.



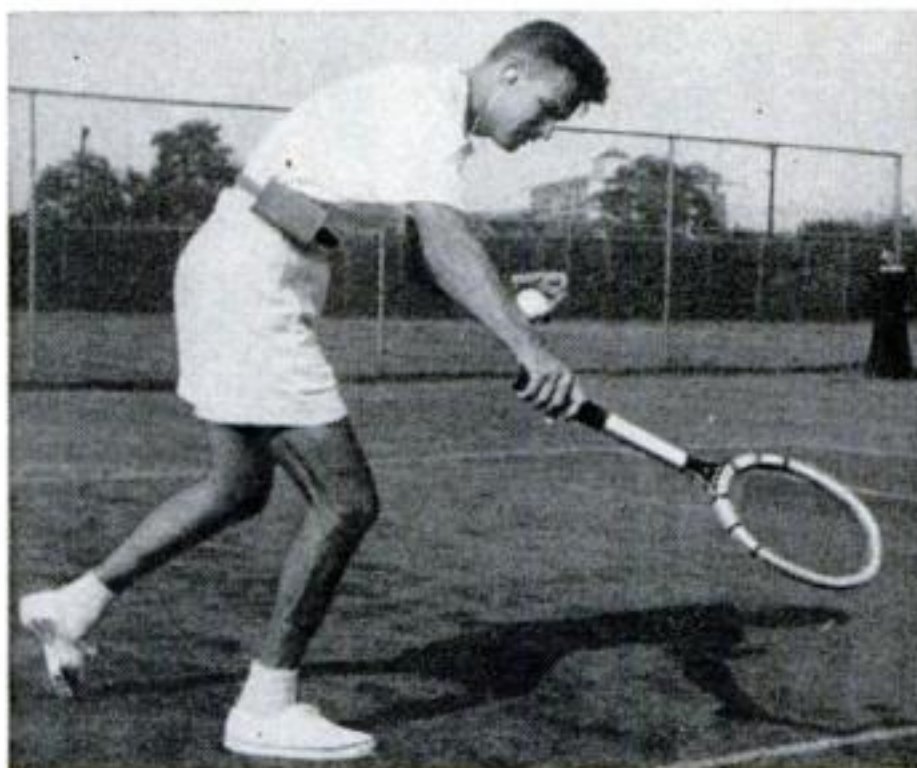
Strong Engine Is Light

THIS 810-horsepower, air-cooled engine, developed for the Army, weighs less than a third as much as a liquid-cooled power plant of the same capacity. Needing no radiator, it also not only takes up less room but is less vulnerable to enemy guns.

The V-12 above is only one of a versatile

line of new engines using standardized cylinders, pistons, rods, bearings, etc., that can be assembled in 6-, 8-, and 12-cylinder combinations—with different blocks and shafts—to produce 375 to 1,400 hp.

Continental Motors developed both those heavy-duty engines and a lighter line that uses interchangeable parts in 4-, 6-, and 8-cylinder models of 125 to 250 hp.



Radio Coaches Athletes

Now a sports coach can whisper instructions into a player's ear without interrupting practice. The radio system that makes this possible is shown in use during workouts for the Davis Cup tennis matches. Signals are short-waved from the battery-powered transmitter at right. The receiver, scarcely bigger than a tobacco can, is strapped to the play-



er's waist and wired to a hearing-aid phone in his ear. With the broadcasting antenna telescoped, the whole Coachmaster® outfit can be carried in a suitcase.



Mobile house has main room 11 ft. long, 6½ ft. wide, 6½ ft. high. Walls and roof of 3/16-in. waterproof plywood and floor of fiberboard are

riveted to welded angle-iron frame. Plywood roof extension and three canvas walls add an outdoor room of the same size without floor.

Pocket-Size Home For Family of Four



At one end of main room is dinette designed like Pullman section to make over at night into a double berth. Seats and one-legged table, made of ½-in. plywood, extend 2½ ft. from wall. Rack on the wall, over the table, holds glasses.



For sleeping, canvas bunk on metal frame folds out from wall as upper berth. Lower is made by laying table top across seats and using four seat cushions as mattress. Bunks are 6 ft. long. Behind housewife is a full-length wall mirror.

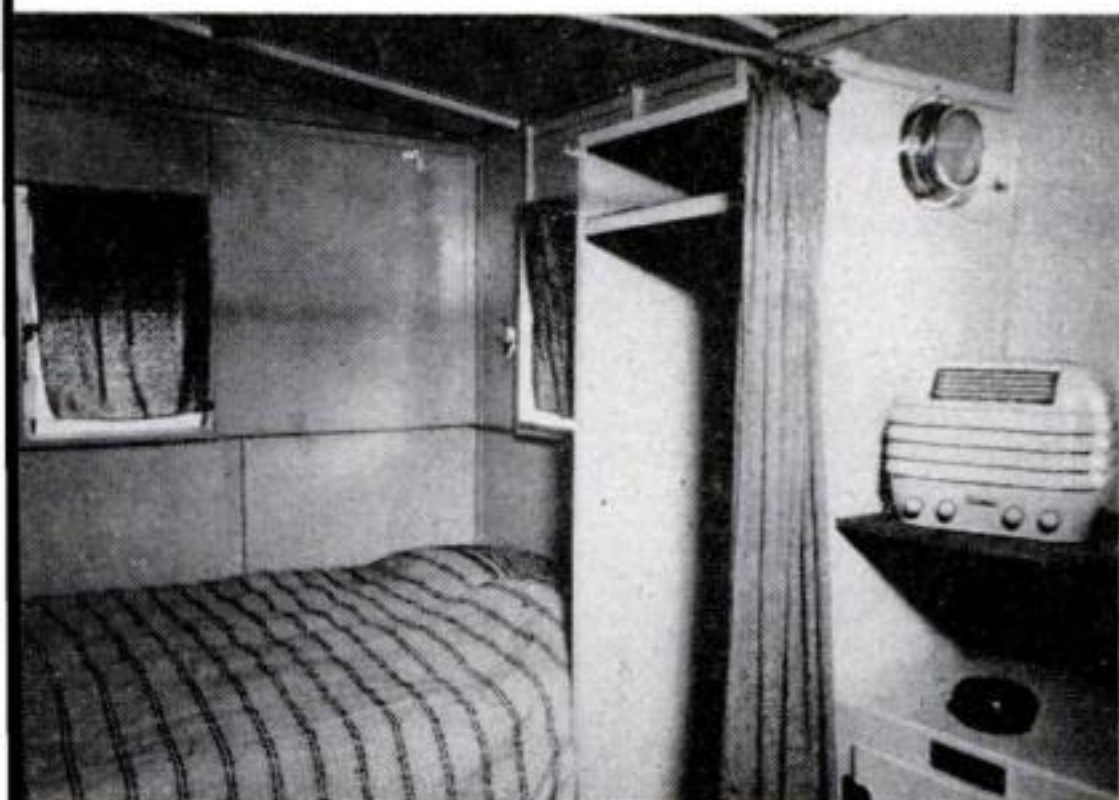


Outdoor kitchen has shelves and cupboards recessed into front wall of main room for oil or electric stove, two 3-gallon water tanks, pots

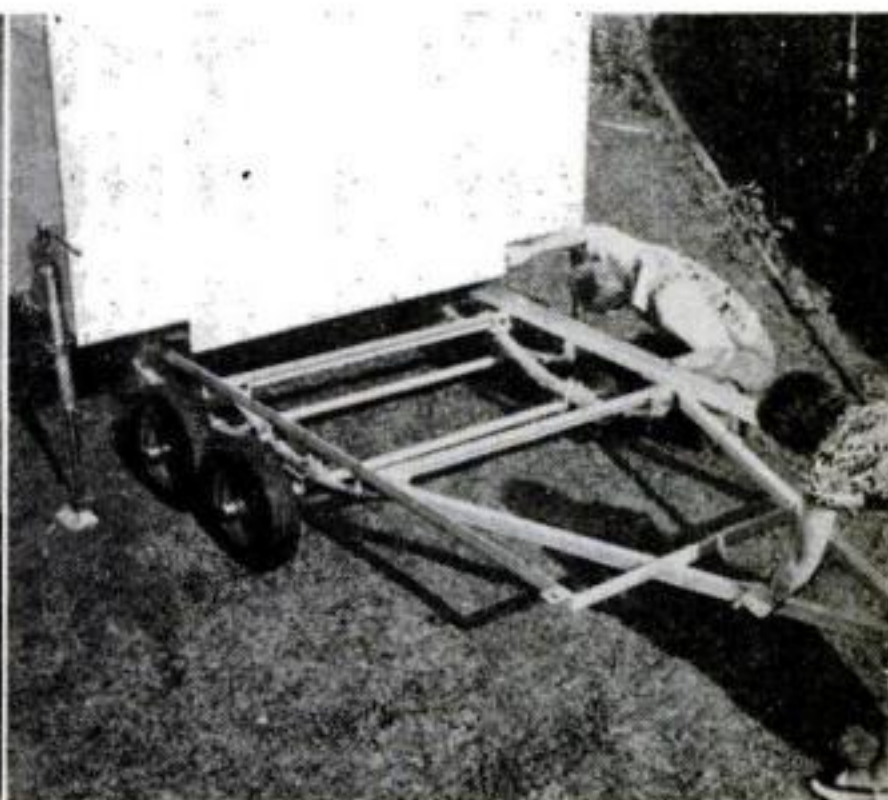
and pans, and toilet articles. Folding table clamps to wall. One of small wheels that support house can be seen near housewife's foot.

HERE'S news for house-hungry America from house-hungry Australia: the Pocket Home[®], now in production and selling for the equivalent of \$1,152. To get around legal requirements for permanent dwellings, the house is set on four small wheels. Its ingenious use of small space makes room for a

family of four. And by sharing community toilets and baths with the neighbors in a Pocket Home village, they can get along comfortably—in Australia's mild climate—while waiting for a permanent house. The designer, Arthur R. Turner, plans to include bath and laundry in a de luxe model. **END**



At opposite end of room, under screened windows, is double bed. A storage bin underneath is 6½ ft. long, 4½ ft. wide, and 9 in. deep. Curtain on hinged rod can cover wardrobe or be pulled across room as temporary partition.



For camping trips, Pocket Home is lifted off its own wheels by four jacks and lowered onto rubber-tired carriage that hitches behind a car. Canvas walls of outdoor room are stowed inside, and roof extension folds down flat.

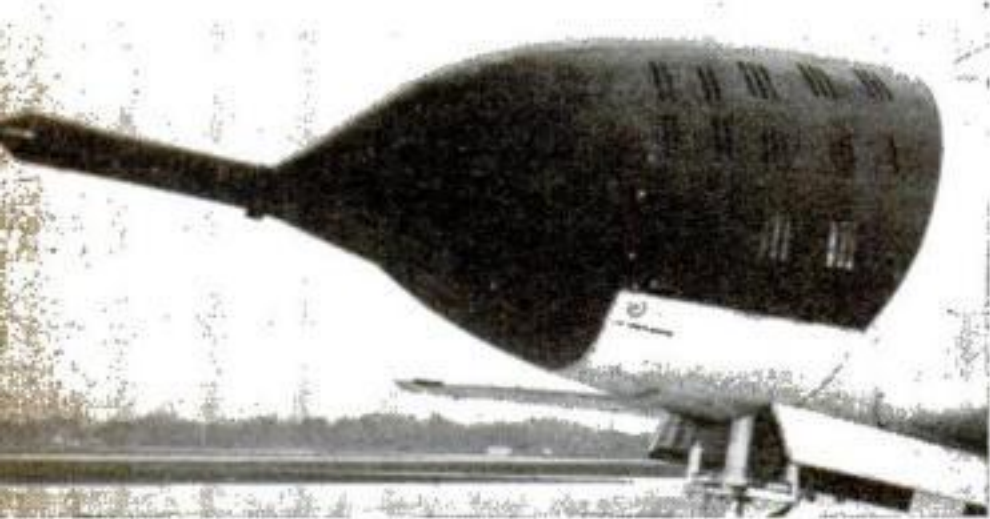
What's New in Aviation



Fighter Gets X-Ray "Eyes."

That's all the Air Force will say about the new radar equipment of this new Northrop XF-89. The all-weather fighter will be able, however, to seek out enemy aircraft and ground installations by night or day in any weather. Designed for mass production, the

F-89 is smaller but heavier than its World War II predecessor, the F-61 Black Widow night fighter. Two jet engines nestle side by side under the fuselage, and the rear horizontal stabilizer has been moved halfway up the vertical stabilizer to avoid the twin blasts of hot gases from the jet exhausts.



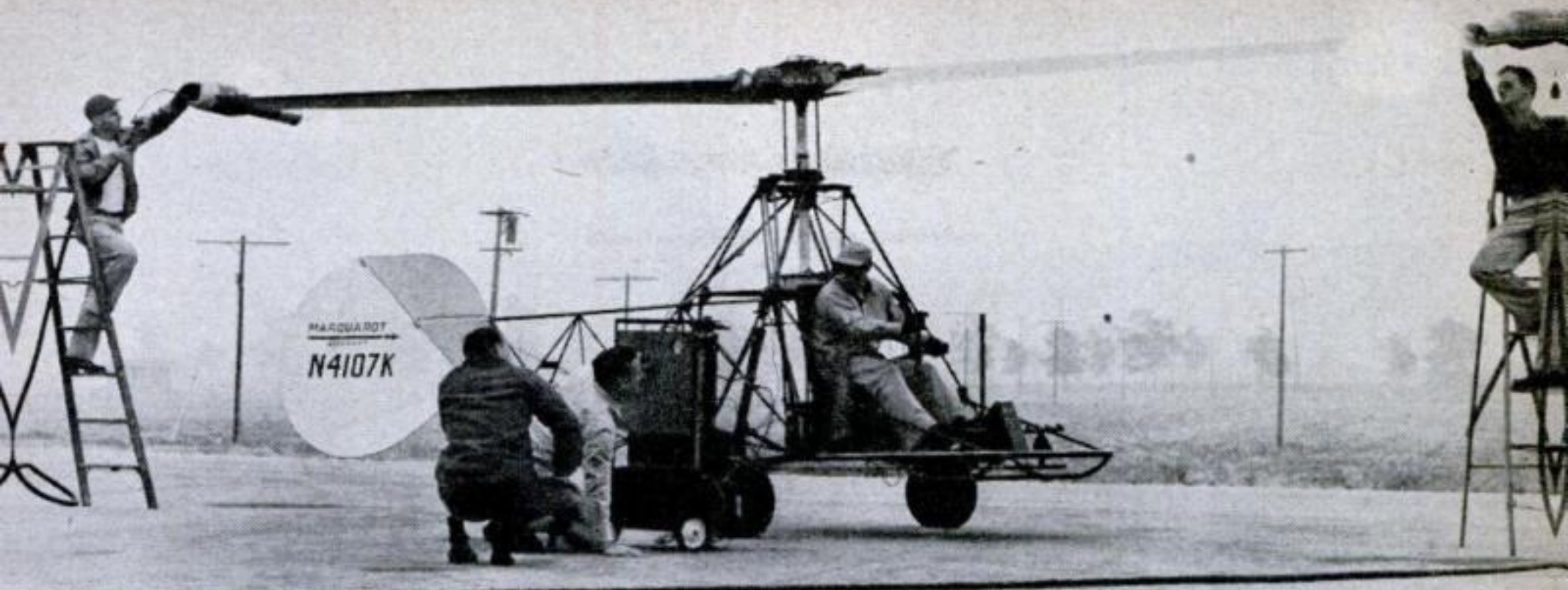
Jet's Nose Tests Rocket Fire.

The snoutlike tube installed in the nose of the F-80 at left is teaching the Air Force tricks in launching rockets from high-speed airplanes. Developed by the United Machinery Corp., in conjunction with the Air Force, the device is electrically powered to fire automatically six rounds of 38-pound rockets. Slots seen in the side of the plane's nose are necessary to equalize pressure differentials resulting from the rocket blasts.

Jet Gives Added Boost. This new Navy XAJ-1 may look like a conventional twin-propellered attack plane, but there's a GE-Allison turbojet engine in the tail of the fuselage for extra speed in combat emergencies. Designed by North American

for carrier operations, it has Pratt and Whitney Wasp Major reciprocating engines. Manned by a crew of three, the XAJ-1 is faster and can carry a heavier bomb load than present carrier types. Outer wing panels and vertical tail fold for parking.





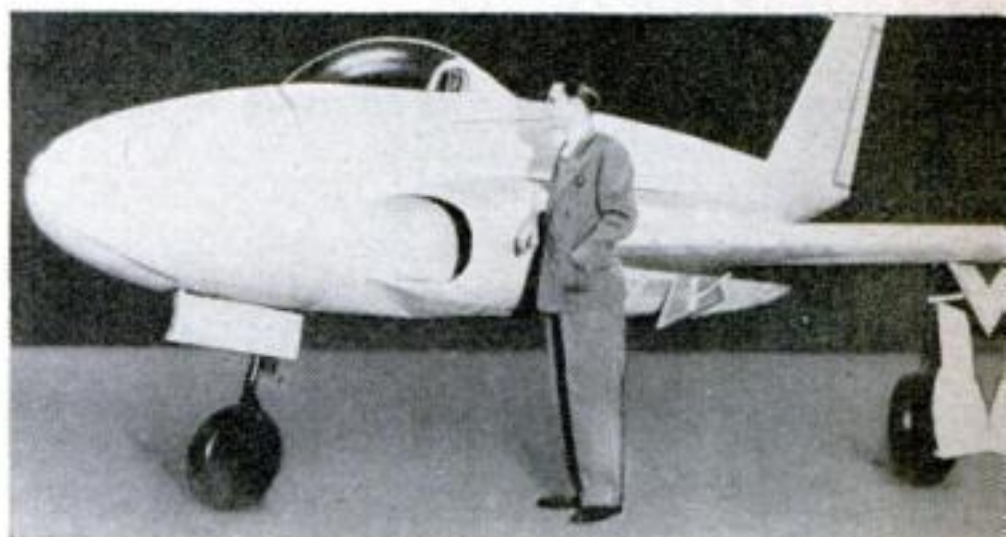
Pulsejet Power for 'Copter.

Compressed air is being directed into the rotor tips to start the light pulsejet engines of the new Marquandt Whirlajet®. These engines replace a heavy internal-combustion power plant, and, according to the General Tire and Rubber Co., will enable its new

helicopter to carry twice the payload of ordinary types over short distances. In the pulsejets, air is admitted in bursts through a slatlike valve opened and closed by engine pressure changes. Both fuel and ignition are supplied to the jets by lines running through the blades of the rotor.

Built for Speed of Sound.

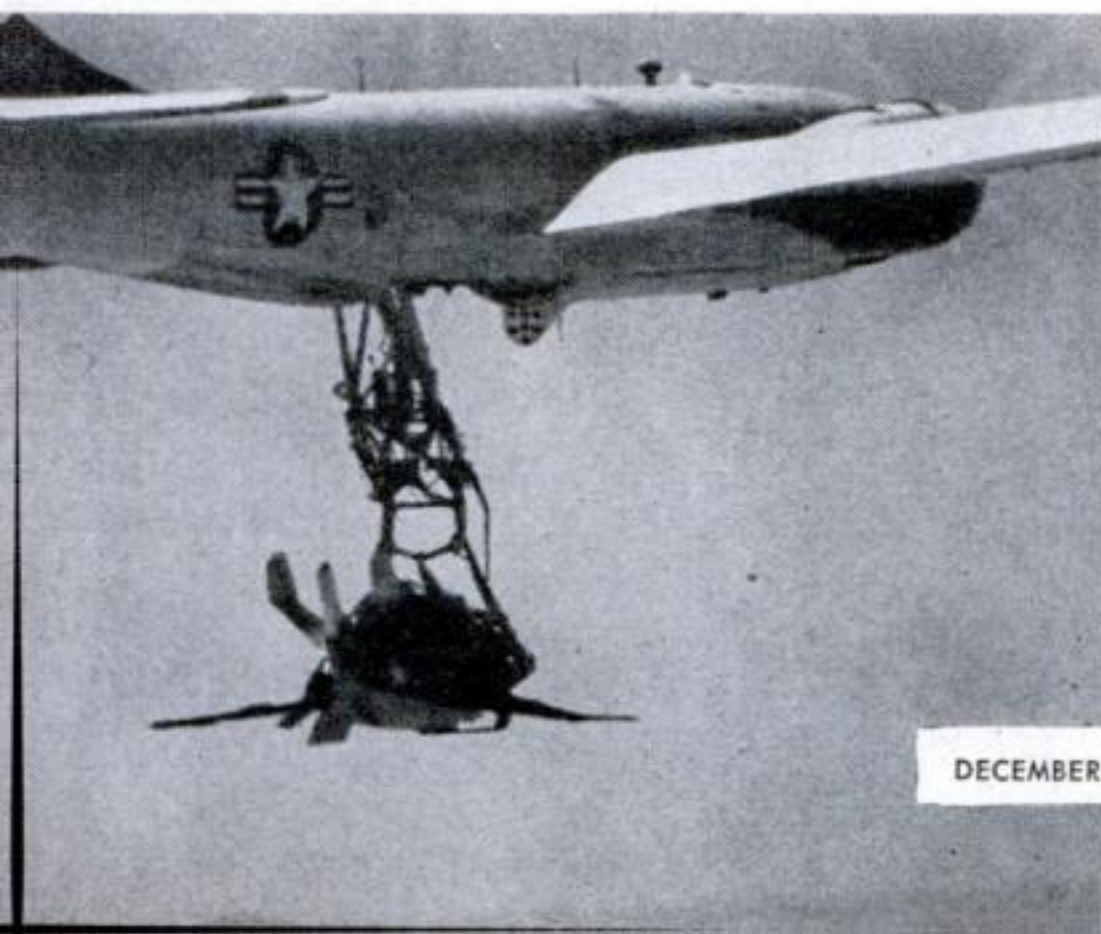
Soon to join the Air Force experimental team is the Northrop X-4, the small but sleek and powerful sonic-zone flying laboratory shown in mockup at right. The 20-foot plane, with a wing span of 25 feet, adapts the low-drag Flying Wing principle to speed-of-sound research. Powered by gas-turbine engines, the X-4 is capable of much longer flights than the rocket-powered X-1, first plane to fly faster than sound.



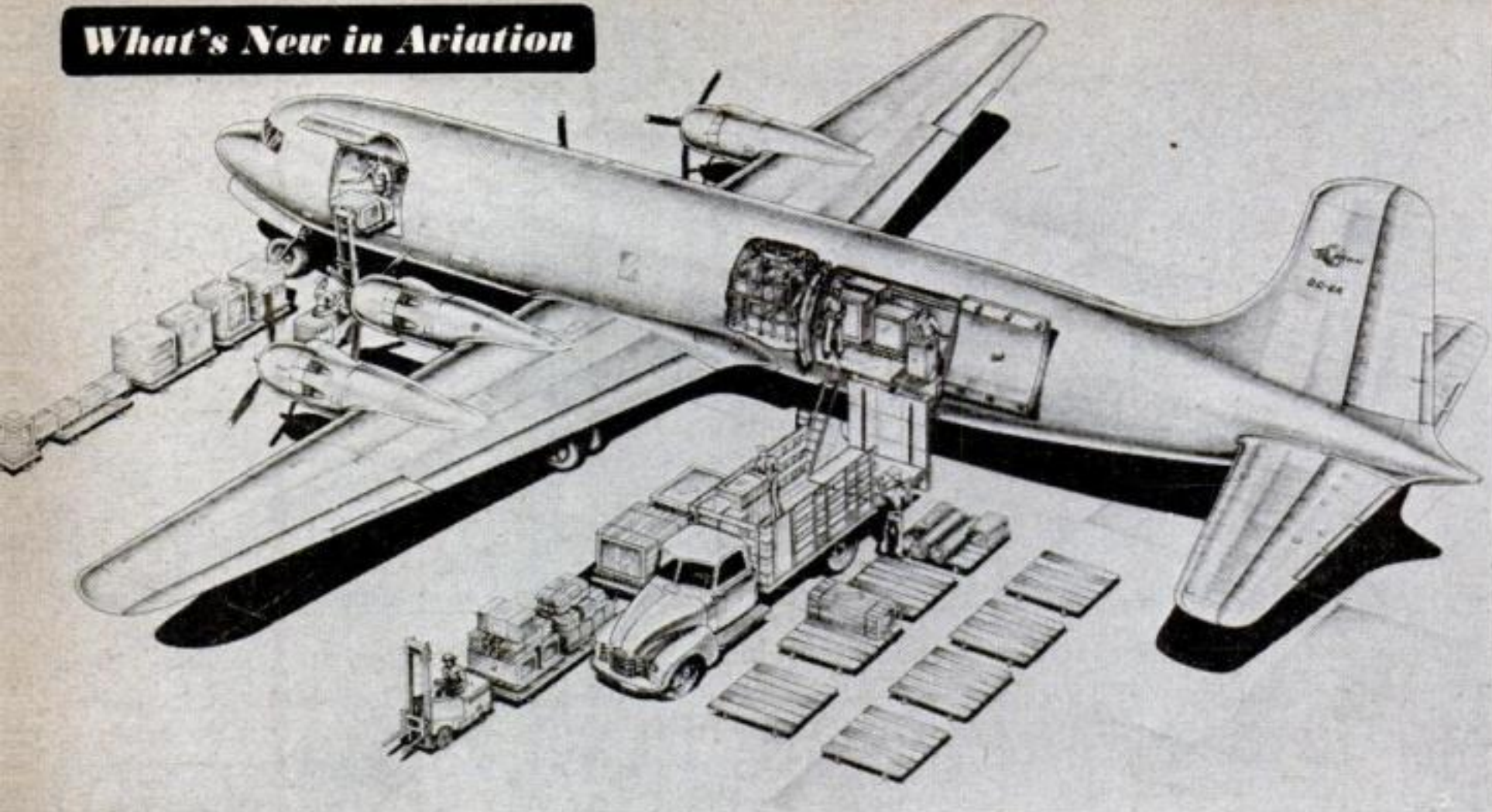
Launched from a Trapeze.

Being lowered from the bomb bay of a modified B-29 Superfortress, a tiny McDonnell XF-85 parasite jet fighter, at left below, is about to fly off on its own. At right, the junior jet, designed for launching from the giant six-

engine B-36 Superbomber (PS, July '48, p. 97) is shown just after release. In this first experimental flight at Muroc Dry Lake, Calif., the XF-85's canopy was struck in an attempted mid-air hookback. The jet landed on skids with only slight damage.

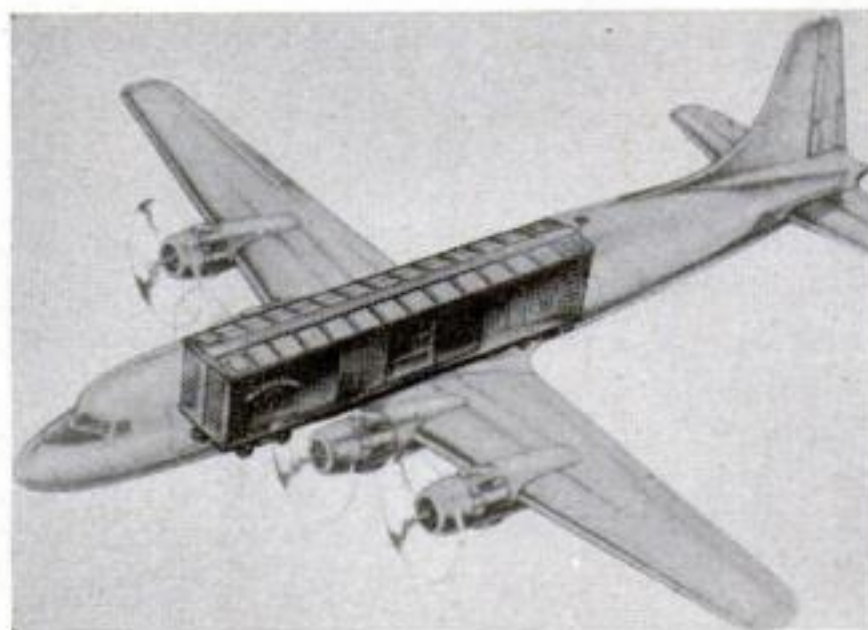


What's New in Aviation



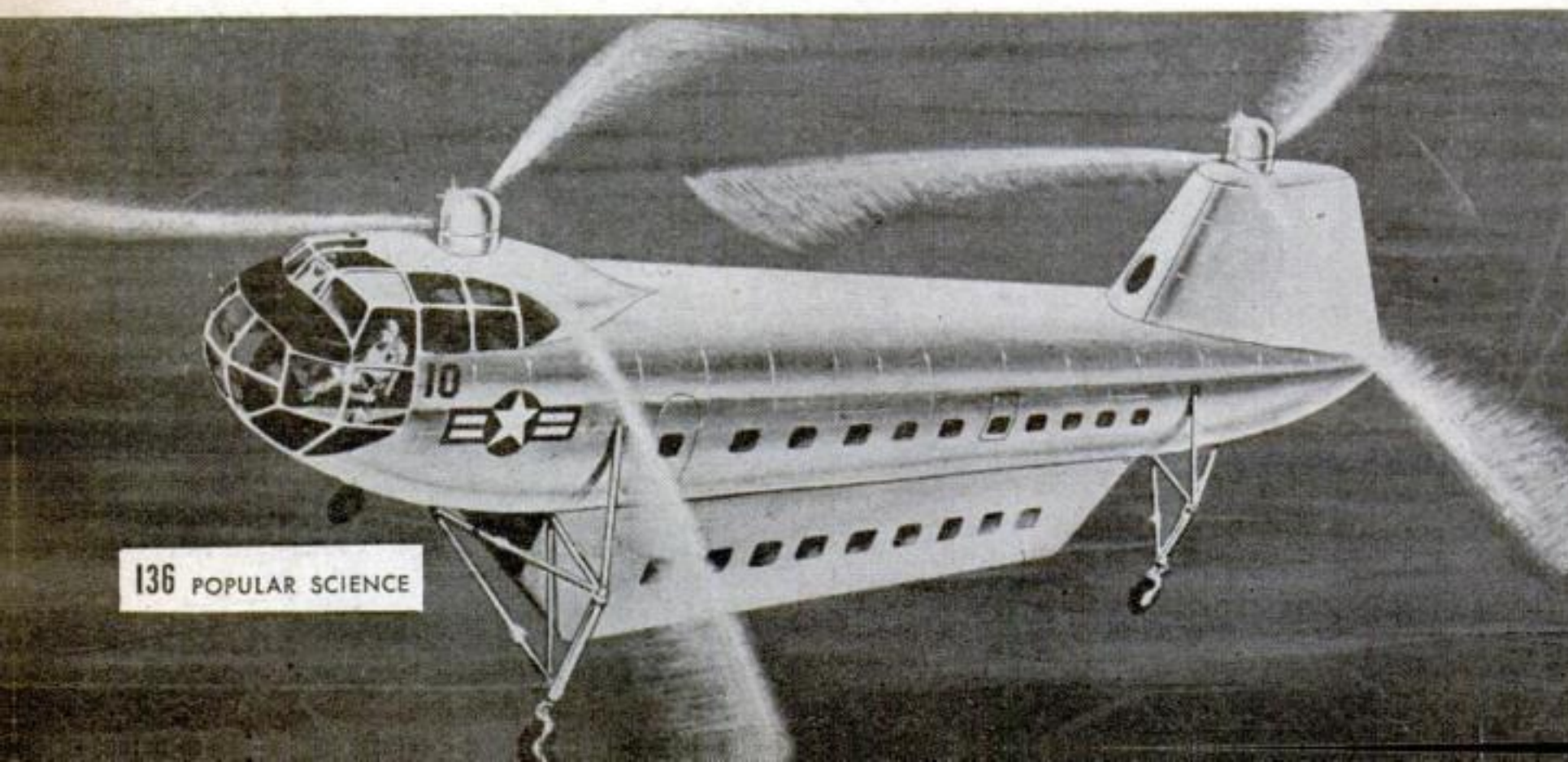
Longer Body, More Freight.

Cargo loading is stressed in this artist's conception of the new Douglas DC-6 Air Freighter®. Doors fore and aft and a large open cargo compartment speed freight handling. The plane will haul nearly 12 tons of fresh food from California to New York in nine hours, non-stop. Five feet longer than the present DC-6, the plane has greater cargo volume than a railroad boxcar. Planned for spring delivery, the Air Freighter will have built-in power lifts to speed loading from truck beds or platforms.



Helicopter Grows Up. Below is what the "world's largest" helicopter will look like. Being built by the Piasecki Helicopter Corp., it is designed to carry the biggest load and have the longest range of any rotary-wing aircraft, and its all-metal fuselage will compare in shape and size to that

of a DC-4. The compartment below it is a detachable capsule, about as big as a trans-continental bus, that will double the 'copter's capacity as a transport or air ambulance. The plane is designated the XH-16. Two prototypes are expected to be delivered to the U. S. Air Force within two years.





Safety Rod Bars Bumps

A CAR'S right front seat may cease to be known as the "death seat" if this new Safety Bar Rest[®] works out as expected. Made of aluminum in two telescoping sections and screwed to the door, it can be pulled across a passenger's abdomen to prevent crashing into the dashboard or windshield when an accident or sudden stop occurs. When not in use, the device folds against the door for use as an armrest.



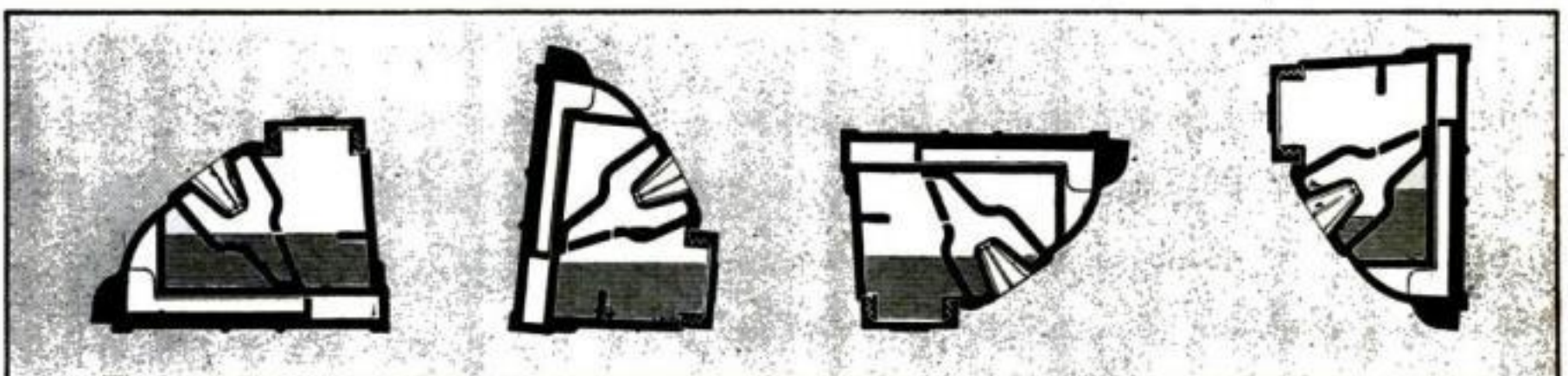
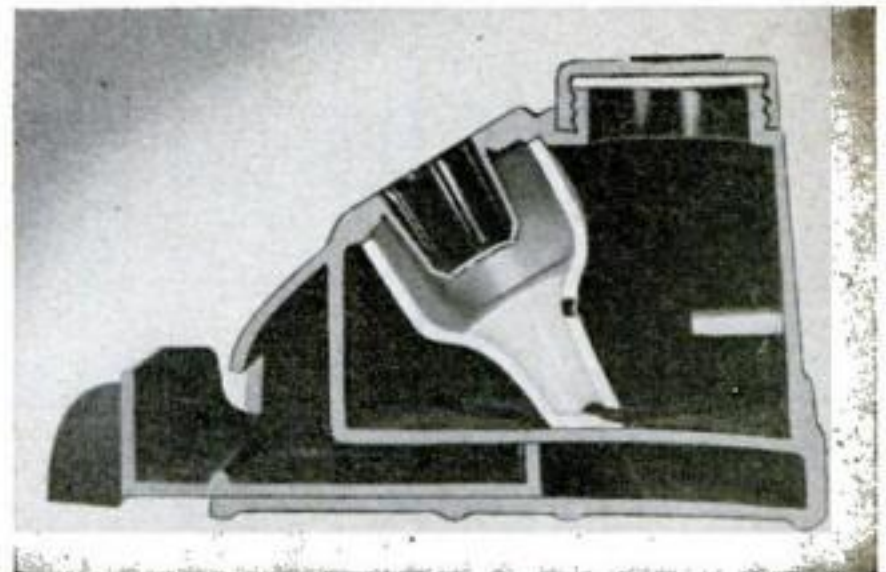
Spring Rocks Horse

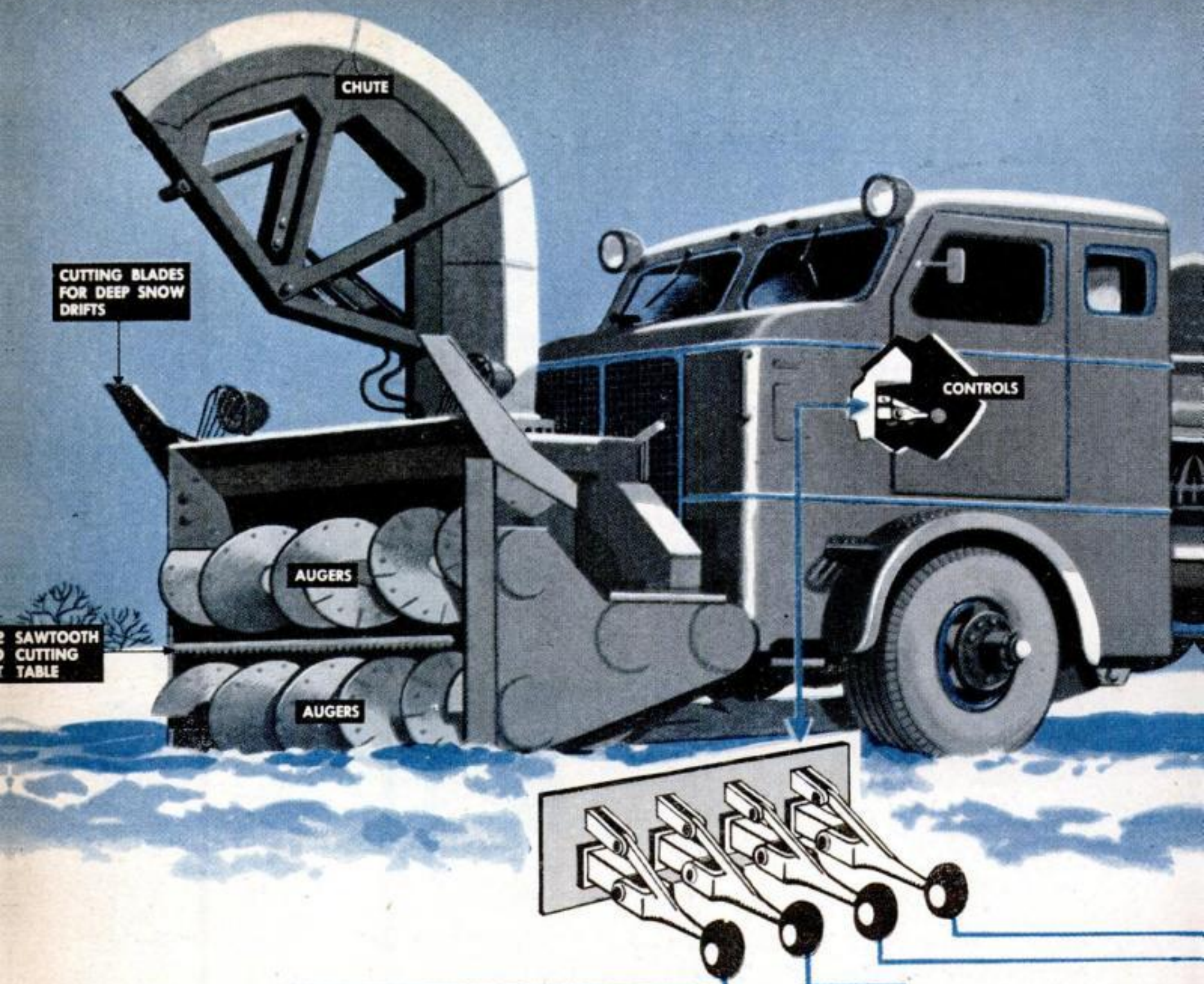
SPURRED by a steel spring, this rocking horse gives a child a fast ride for little effort. When the rider leans back, his weight pushes the saddle down, as shown at right; when he bends forward, the spring pulls it up. Stirrups ahead of the seesaw pivot help him shift his weight to keep the horse rocking. Designed by Raoul Nol, a French inventor, the sturdy toy is assembled with bolts to prevent its shaking apart.



Inkwell Won't Spill

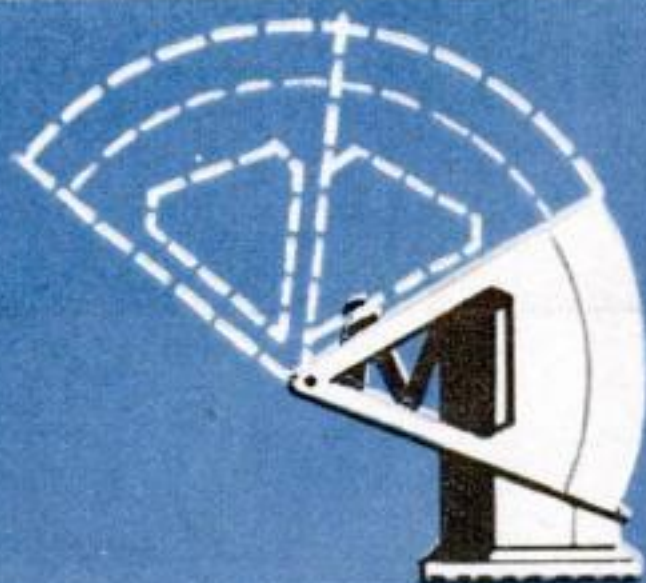
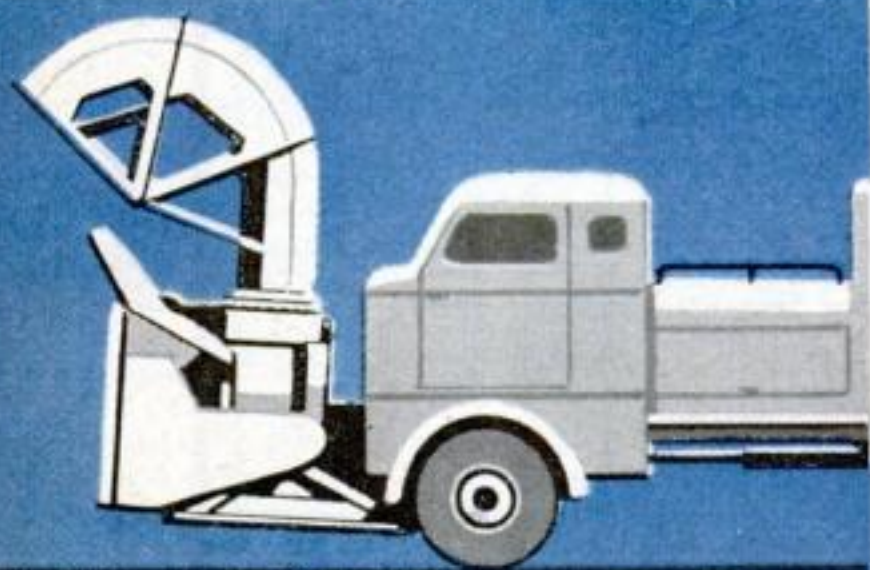
You can tip this inkwell on its side or upside down without spilling a drop. The secret is a reservoir around the dip well. This is filled only to the white mark on the photo at right. In any position except upright, as shown below, the ink level then remains below the openings between the reservoir, dip well, and pen socket. The new Spil-Pruf[®] desk set has passed U. S. Marine tests for use in ships and field offices.





First lever raises the front assembly 12" above road to give clearance in traveling to or from jobs. The driver sits on the right side of the cab so that he can watch the curb clearances.

Next lever erects chute for various types of operation. By closing the forward arc of the delivery chute, the operator can direct the snow downwards at sharp angle into open trucks.



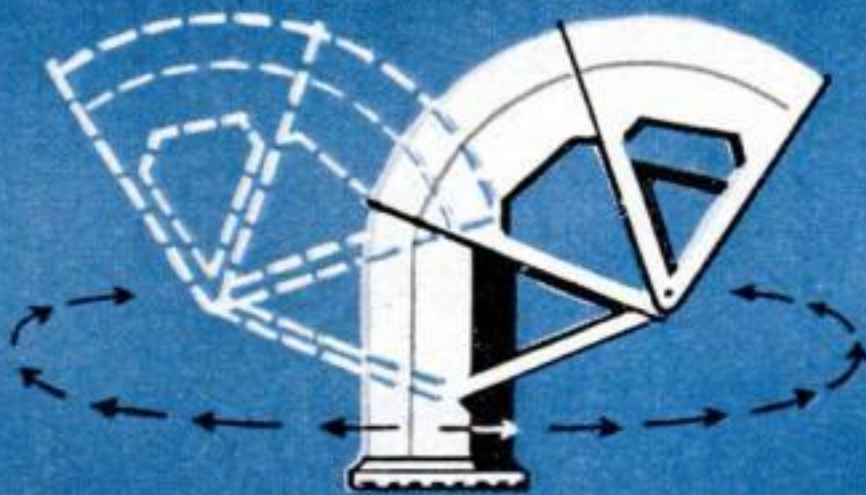
Blower Makes the Snow Fly



THE Snow Master[®] can make a blizzard of its own—but it's a blizzard with a blessing. With its blower turbine set for full power, it can throw snow 150 feet to clear highways or airports. For cleaning streets, with the sectional chute adjusted for loading, it can fill a standard snow truck in less than a minute. The rotary cutting augers can handle and dispose of hard and compacted snow resulting from several snowfalls, and even break up block ice.

The auger blades and the speed of the turbine behind them are regulated so that power is applied to both to match the resistance offered by the volume and type of snow being removed. Increased resistance means that more fuel will be fed to the engine operating the assembly. This control saves unnecessary wear and tear on motor and blades. The Snow Master unit, or front assembly, is mounted on a basic heavy-duty truck powered by its own gasoline engine located under the cab. This arrangement shortens the over-all length, and gives both driver and operator greater visibility. Sicard Inc., of Montreal, Canada, is the manufacturer.

This lever revolves chute, right or left, up to 220°. The angle at which the snow is ejected is also controlled by the operator from the inside of the cab, permitting piling in banks.



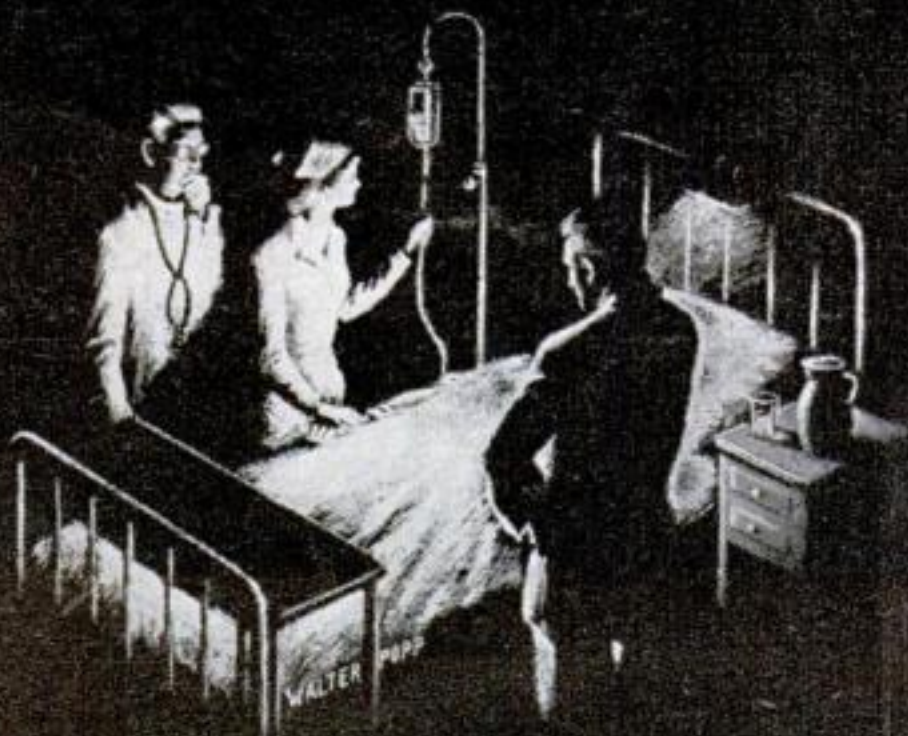
Last lever turns turbine housing into proper position for loading or blowing. Snow, ground up by the augers, is caught by six impeller blades and delivered to chute at high velocity.



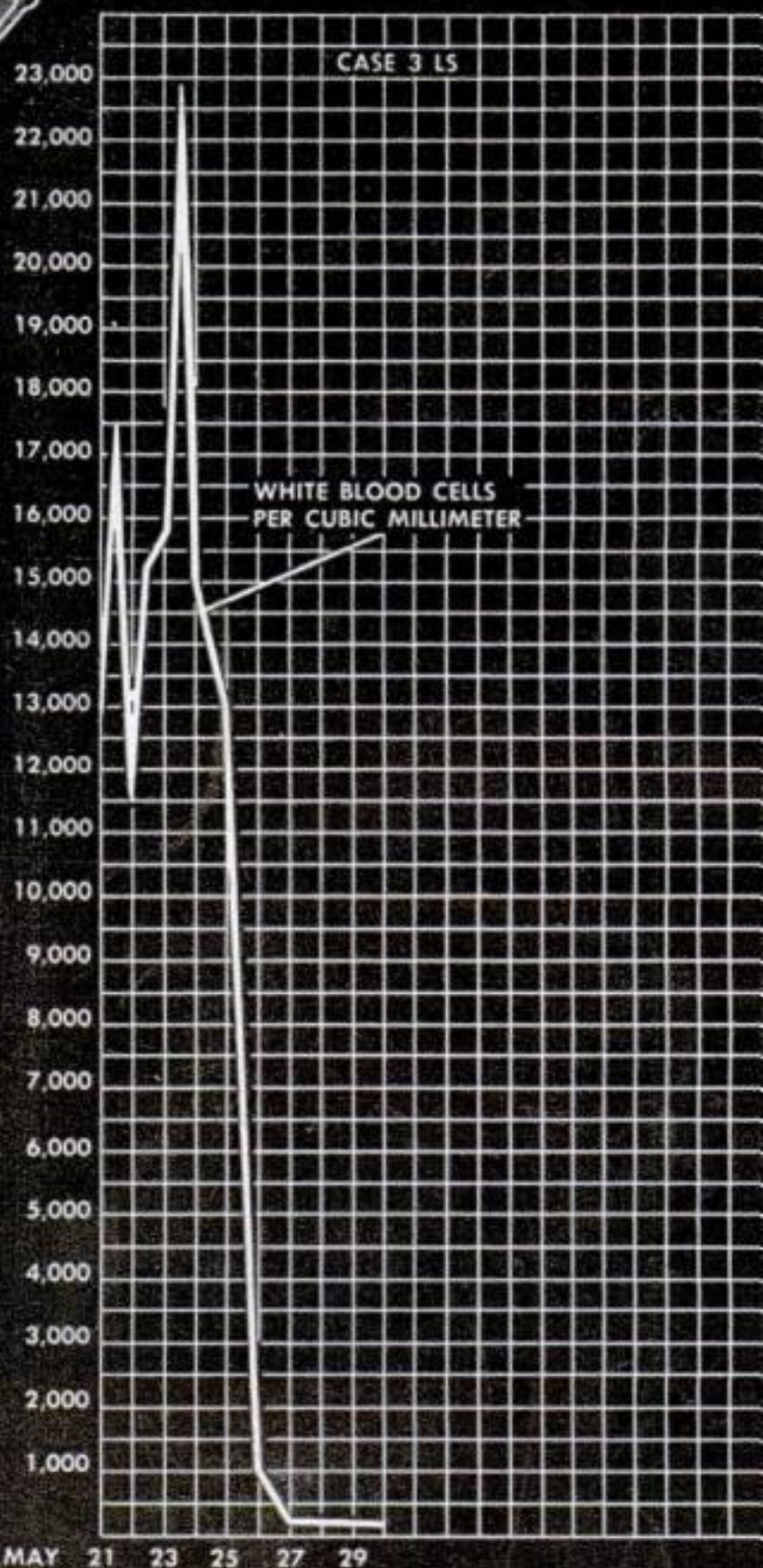
THE CASE OF
DR. SLOTIN

Danger...

An accidental chain reaction, following a slip in handling plutonium, produced a flash of deadly radiation in the Los Alamos atom bomb laboratory on May 21, 1946.



Saving the lives of the others present by knocking the apparatus apart, Dr. Louis Slotin received a fatal dose of rays. Despite every hospital treatment, he died in nine days.



To aid medical science, he cooperated in making records of his case, including this chart, which strikingly shows virtual disappearance of white corpuscles from the blood.

...Radiation



New sources of rays and applications for them—in medicine, industry, and research—make living safely with radioactivity our latest problem.

By Alden P. Armagnac

WHEN you see a sign bearing a magenta pinwheel on a yellow background and the words "DANGER — RADIATION," don't snoop!

Now being used in leading atomic-research centers, and shown above, this newly adopted warning symbol marks the entrances to "hot" laboratories and identifies containers that might be radioactive. It bespeaks a new hazard of this Atomic Age—peril from invisible rays.

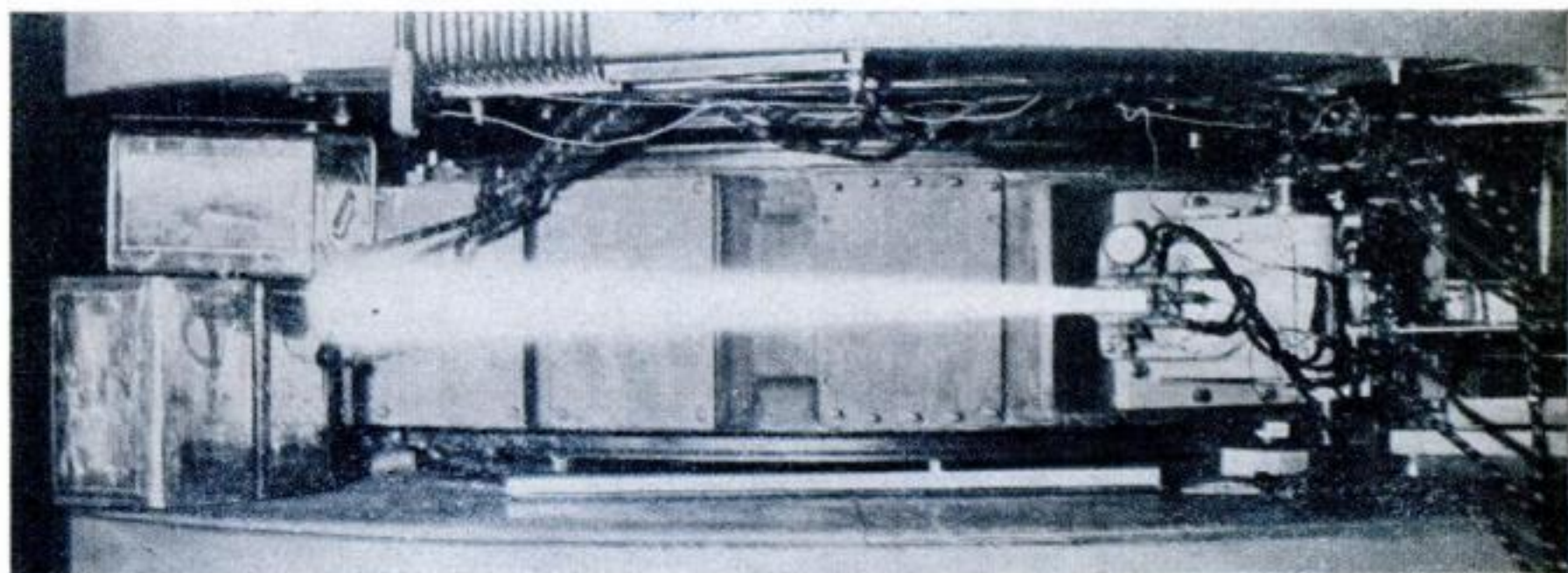
Radium and X-ray tubes, about the only known sources of dangerous radiation a generation ago, merely begin today's list. Now we have fissionable materials such as plutonium and uranium-235, the therapeutic and "tracer" chemicals known as radioisotopes, and high-voltage cyclotrons, betatrons, and other ray machines of fantastic power.

Whether you are a chemist, a metallurgist,

a mechanic, or a patient in need of an "atomic cocktail," radioactive substances are daily becoming more likely to play a part in your profession or well-being. Radioisotopes already are being used in more than 300 hospitals and laboratories, and applications to industrial problems are multiplying. The biggest "tracer" experiment to date was made in a steel mill.

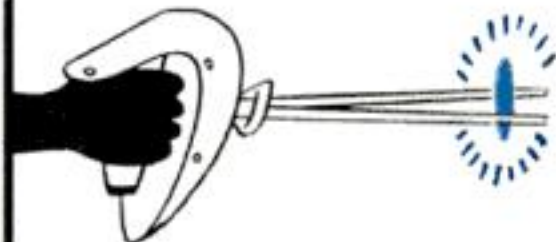
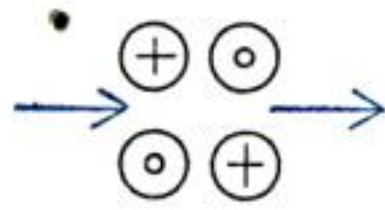


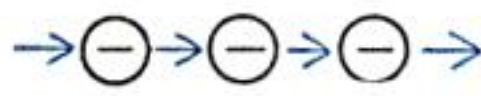
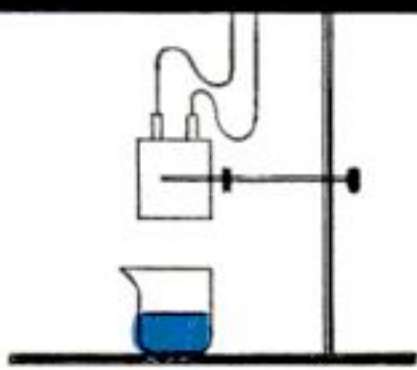


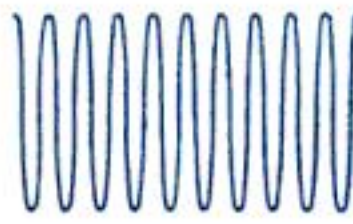


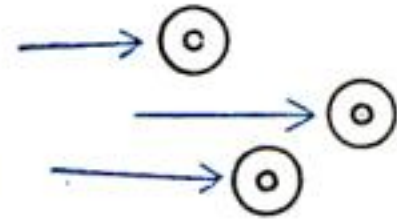
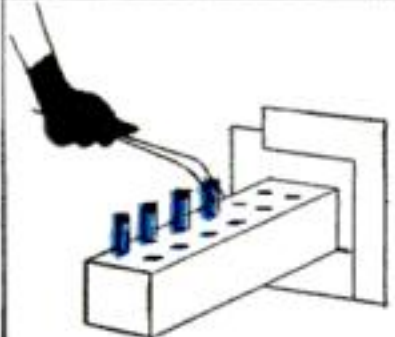
The University of Illinois College of Medicine plans to treat cancer patients with a betatron producing 20-million-volt X rays. A medical betatron of more than double this power has just been completed by the General Electric Company. Multimillion-volt betatrons and semiportable Van de Graaff generators, yielding X rays far more powerful than conventional tubes, also have been put to work in industry. They permit X-raying pieces of steel up to 10 inches thick for flaws.

More and more such work will be done, the experts predict, by machines producing



Bright-blue beam of cyclotron, one of rare visible forms of deadly radiation, consists of

speeding deuterons or heavy-hydrogen nuclei and can kill any living cell it touches.

Kind of Rays	Principal Sources	Nature	Typical
alpha	 <p>Plutonium and other "trans-uranium" elements. Radium, etc. Cyclotrons.</p>	 <p>Positively charged helium nuclei (2 protons, 2 neutrons).</p>	
beta	 <p>Man-made radioisotopes. Betatron, synchrotron, etc. Some of the naturally radioactive elements.</p>	 <p>Stream of charged particles (electrons).</p>	
gamma	<p>Gamma-ray sources: Some man-made radioisotopes. Radium.</p>  <p>X-ray sources: Medical and industrial X-ray tubes. Betatron, etc., with X-ray target.</p> 	 <p>Electromagnetic waves. (Gamma rays are similar to X rays but of shorter wave length.)</p>	
neutron	<p>Chain-reacting uranium pile.</p>  <p>Plutonium, U-235, other fissionable materials. Cyclotron with beryllium target. Radium-beryllium mixture, etc.</p>	 <p>Uncharged particles of extreme penetrating power.</p>	

This POPULAR SCIENCE chart shows you at a glance the principal kinds of dangerous

radiation comparable to that from *pounds* of radium!

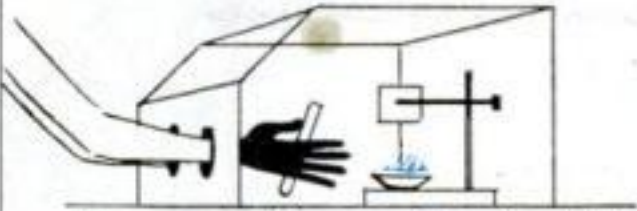


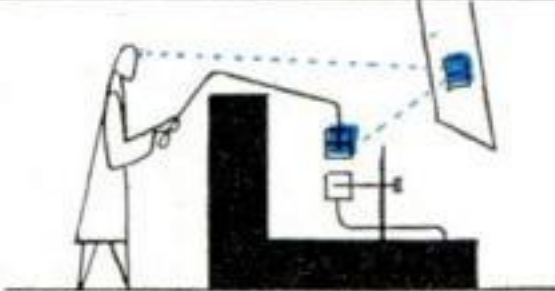

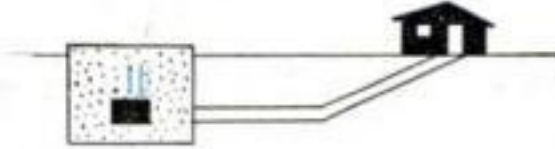
So, like it or not, radioactivity is something we must learn to live with. But no more than a fogbound airman, flying "blind" by instruments, can we depend for our safety on our ordinary senses.

Only occasionally is radiation danger visible—like the weird bright-blue beam of a cyclotron, a cold "fire" as perilous to flick a finger through as the flame of a blowtorch. Geiger counters, clicking like telegraph sounders, and similar instruments must warn of invisible alpha, beta, and gamma rays—

and of a new and equally invisible kind, neutron rays from atomic fission.

All these rays have very similar effects on human tissue, and the marked difference in the injury they can do you results chiefly from the difference in the extent to which they can penetrate the human body. Most dangerous, therefore, are gamma rays; very penetrating X rays, of similar nature; and neutron rays, the most penetrating and damaging of all. To these the body is almost as transparent as window glass is to light.

The strange thing about dangerous or

Applications	Protection Required	Effect on Human Body
Luminous watch, clock, and instrument dials. Static-electricity eliminating devices, for printing presses and other industrial machines.	 <p>Extreme precautions, resembling "aseptic" technique against germs, to avoid touching or inhaling alpha-ray chemicals.</p>	 <p>ALPHA RAYS do not penetrate unbroken skin, have extremely short range, and are harmless externally. But "alpha emitters" like plutonium are among the most dangerous substances to get into the body, where they lodge in the bones and their rays attack blood-forming tissues.</p> <p>BETA RAYS penetrate skin only slightly and can cause no more than superficial injury.</p>
Tracer chemicals for all types of research. Therapy with radioisotopes such as phosphorus 32.	 <p>Moderate precautions to avoid close-range exposure. Rays do not appreciably penetrate rubber gloves, ordinary clothing, or light shields of plastic material.</p>	
Medical and dental examination and diagnosis with X rays. Industrial radiography of castings for detection of flaws, etc. Therapy with radium, X rays, betatron, and radioisotopes.	 <p>Medium to heavy shielding (lead bricks or concrete walls). Remote-controlled methods for chemical manipulations.</p>	 <p>GAMMA AND NEUTRON RAYS can penetrate the body completely and cause serious injury or death. These are the lethal rays of the atom bomb. Mild overexposure leads to "radiation sickness" or nausea and sometimes results in loss of hair. Deep-seated effects of acute exposure, any one of which may be fatal, include depletion of white blood corpuscles, anemia, and internal hemorrhages.</p>
Manufacture of many man-made radioisotopes in the uranium pile. Production of chain reaction in uranium pile and atom bomb. Possible future use in cancer therapy.	 <p>Heaviest shielding of all, including massive concrete walls, tanks of water, and paraffin blocks. Powerful sources operated below ground level by remote control.</p>	

Miles

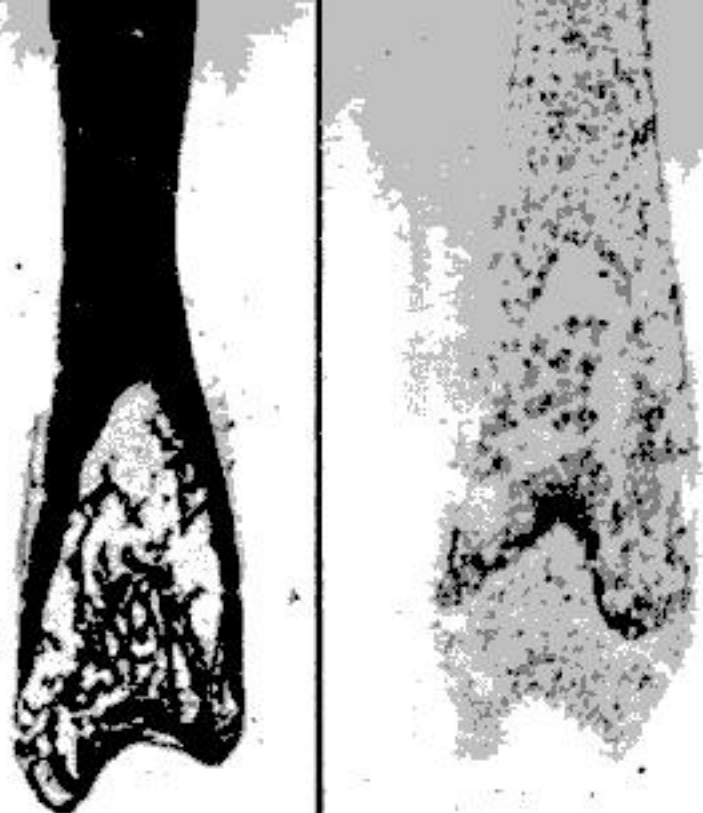
radiation, their sources and applications, and protective measures for working with them.

even fatal overexposure to these rays is that at first a victim feels no ill effects whatever. First symptom, following in a few hours, is the brief attack of nausea and vomiting familiar to X-ray therapists as "radiation sickness." After some days, a victim's hair may begin falling out. Alarming as this may be to him, it is only a surface effect of the rays and not necessarily an ominous sign in itself. His hair will grow back again if he recovers. More serious are deep-seated injuries to blood-forming centers like the bone marrow, with resulting depletion of white corpuscles, red corpuscles, and blood-clotting elements.

Death through infection, anemia, or internal hemorrhages may follow.

To prevent this, a whole new science of precautionary measures has been developed. It is enriching our language with such terms as the "hot cell," the "dry box," and the "Cutie Pie."

Walls of concrete up to 10 feet thick around uranium piles and the largest cyclotrons and betatrons give these remote-controlled installations the appearance of military fortifications. Sunken sites, below ground level, for the most powerful ones heighten the impression. Surrounding earth



Blackened areas in these two "radioautographs" of rats' bones register alpha rays from plutonium (left) and americium, another man-made "trans-uranium" element (right), injected into laboratory animals. Tests showed hazard of rays' damage to blood-forming marrow.



Heart of the 50,000,000-volt GE medical betatron is this doughnut-shaped tube, modern high-power successor to bulbous X-ray tubes of conventional design. When electrons speeding around the circular course hit a target, they produce X rays of extreme penetration.

helps absorb any stray rays before they endanger the neighborhood. Lead bricks also make an effective barrier against their gamma rays, and tanks of water or paraffin blocks against their neutrons.

"Hot cells," cubicles of concrete two feet or so thick, serve for operations with "hot" or highly radioactive chemicals emitting up to 100 "curies" of radiation—the equivalent of nearly a quarter-pound of radium. A typical Oak Ridge hot cell for purifying mass-produced radioisotopes encloses a space six feet long, four feet wide, and eight feet high. Using a periscope and twirling the handles of remote controls, an operator standing outside manipulates a whole train of chemical apparatus within. Safety experts check exterior radiation with a portable pistol-shaped meter nicknamed the "Cutie Pie" for its diminutive size.

For the average user of radioisotopes, the small quantity employed requires much less elaborate safeguards. Moreover, many useful "tracers" emit only beta rays. These are stopped by light shields of plastic and are largely absorbed by rubber gloves and by ordinary clothing. An experimenter who handles these chemicals with tongs or by strings attached to bottles is well protected.

Plutonium, the atom-bomb material, must be handled as if by surgeons dealing with violently infectious germs. Externally, its alpha rays cannot penetrate unbroken skin and are harmless. But if plutonium once gets into the body—by mouth, by breathing its dust, or through a cut in the skin—it lodges permanently in the bones, and its

rays work havoc with blood-forming tissues. Hence workers wear not only gloves but also special breathing masks whenever there is any chance of inhaling the slightest traces. If possible, plutonium is kept in solution or moist. Otherwise, experiments with it must be performed in a "dry box," an airtight windowed cabinet. Workers insert their hands through gloves sealed in access openings. Departing workers' hands are scrubbed until a telltale ray detector gives them a clean bill of health.

In ordinary chemistry, mixing certain *different* chemicals will cause an explosion. But merely gathering enough of the *same* fissionable material, like plutonium, in one place will set off a chain reaction—such as occurs slowly in the atomic pile, or explosively in the atom bomb—and release the lethal gamma and neutron rays.

This happened on May 21, 1946, at the Los Alamos, N. M., atom-bomb laboratory. With seven others, Dr. Louis Slotin was handling plutonium. Something slipped. The mishap brought together a quantity of plutonium exceeding the danger limit.

There was a strange sort of "explosion" in miniature, without noise or blast—just a blue glow, a flash of heat that could be felt on the skin, and a flood of deadly invisible rays. Perfectly aware of the consequences, Dr. Slotin stood his ground, knocked the apparatus apart before the others could receive a fatal dose of radiation—and, himself, was exposed to thousands of times the amount a person can absorb without ill effect. Despite every known hospital treatment, he

died nine days later, after cooperating in providing detailed records of his case for medical science.

That such an accident is a rare exception is a tribute to the skill of experts in the newly developed science of "health physics." So effective are the precautions they have devised that not one person has been injured by radiation, to date, in the great plutonium-making plant at Hanford, Wash. The uranium-235 and radioisotope plant at Oak Ridge, Tenn., has an equally impressive safety record.

Death rays that can kill a person a mile away are no longer fantasy, but fact, since Hiroshima and Nagasaki. About 26,000 Japanese atom-bomb casualties, or one-seventh of the total, resulted solely from only one second's exposure to gamma and neutron rays loosed at the instant of the bombs' explosions. Obviously there is no minimizing what an atom bomb could do to one of our own cities despite every possible countermeasure.

Heavy as the casualties would inevitably be, however, modern knowledge of the effects of these rays shows how many lives can be saved.

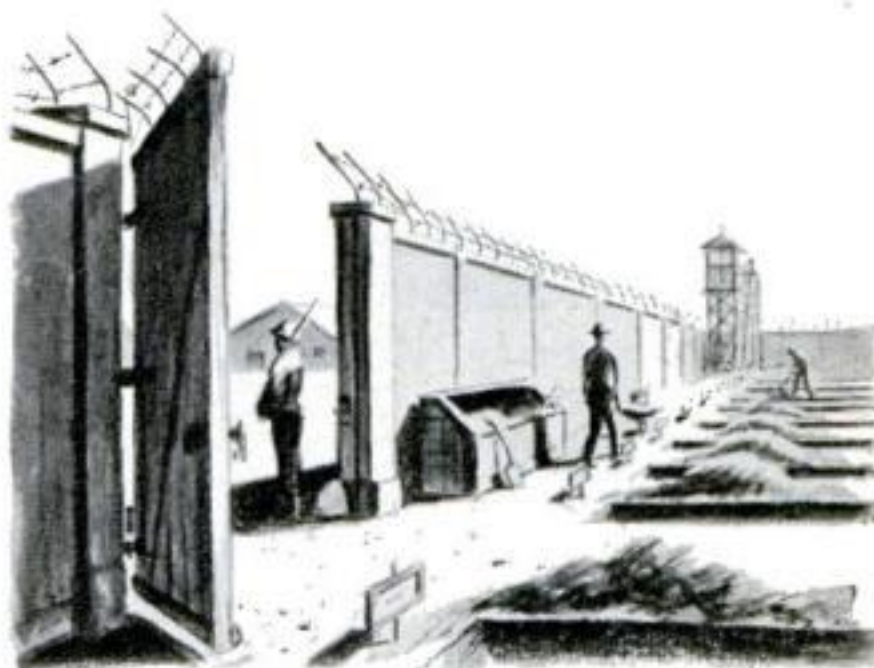
Wholesale blood transfusions, for victims of ray damage to their own blood-forming organs, would tide over those with a fighting chance of recovery. To ward off internal hemorrhages, survivors might receive injections of a dye called toluidine blue, which, scientists have recently discovered, restores the ray-impaired ability of the blood to clot. Other useful drugs may include one called phenylhydrazine, found to be an antidote for ray-induced anemia.

First to enter an atom-bombed area, the U. S. Army Medical Corps foresees, would be a task force of atomic scientists and health physicists armed with Geiger counters. This team would supervise rescue work and direct evacuation of areas rendered uninhabitable by ray contamination—possibly for years or decades. Some of its members would have to check on possible contamination of food, drinking water, and even the clothing of escaping refugees, which might be sufficiently radioactive to be a menace to others. Thus, use of the atom bomb could create the greatest public health problem of all time. As long as the possibility of atomic war remains, and as the atom advances in industry, the need for knowledge and training in radiological safety will be urgent.

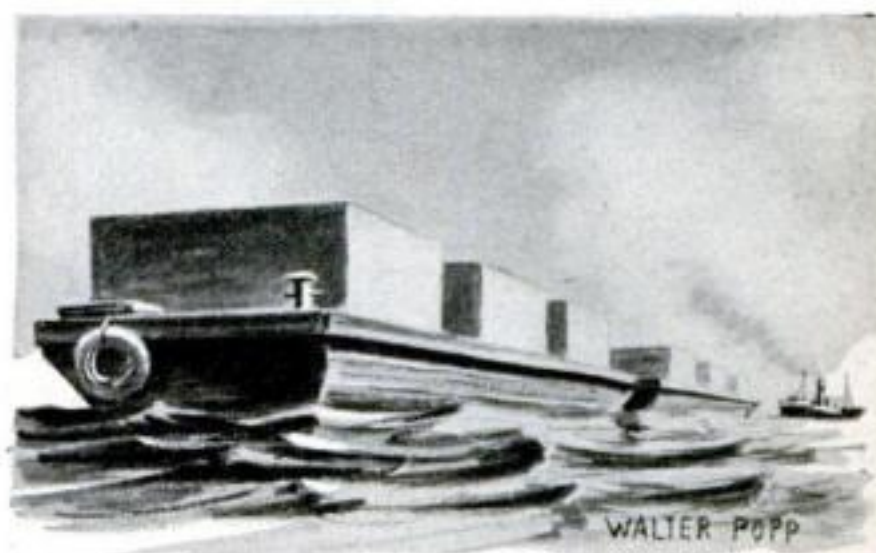
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Getting rid of old razor blades is simple compared to disposing of used radioactive materials. Pouring them down ordinary sink may form plating of radioactive metal in pipe and endanger an unsuspecting plumber. Approved sink connects with receptacle for disposal.

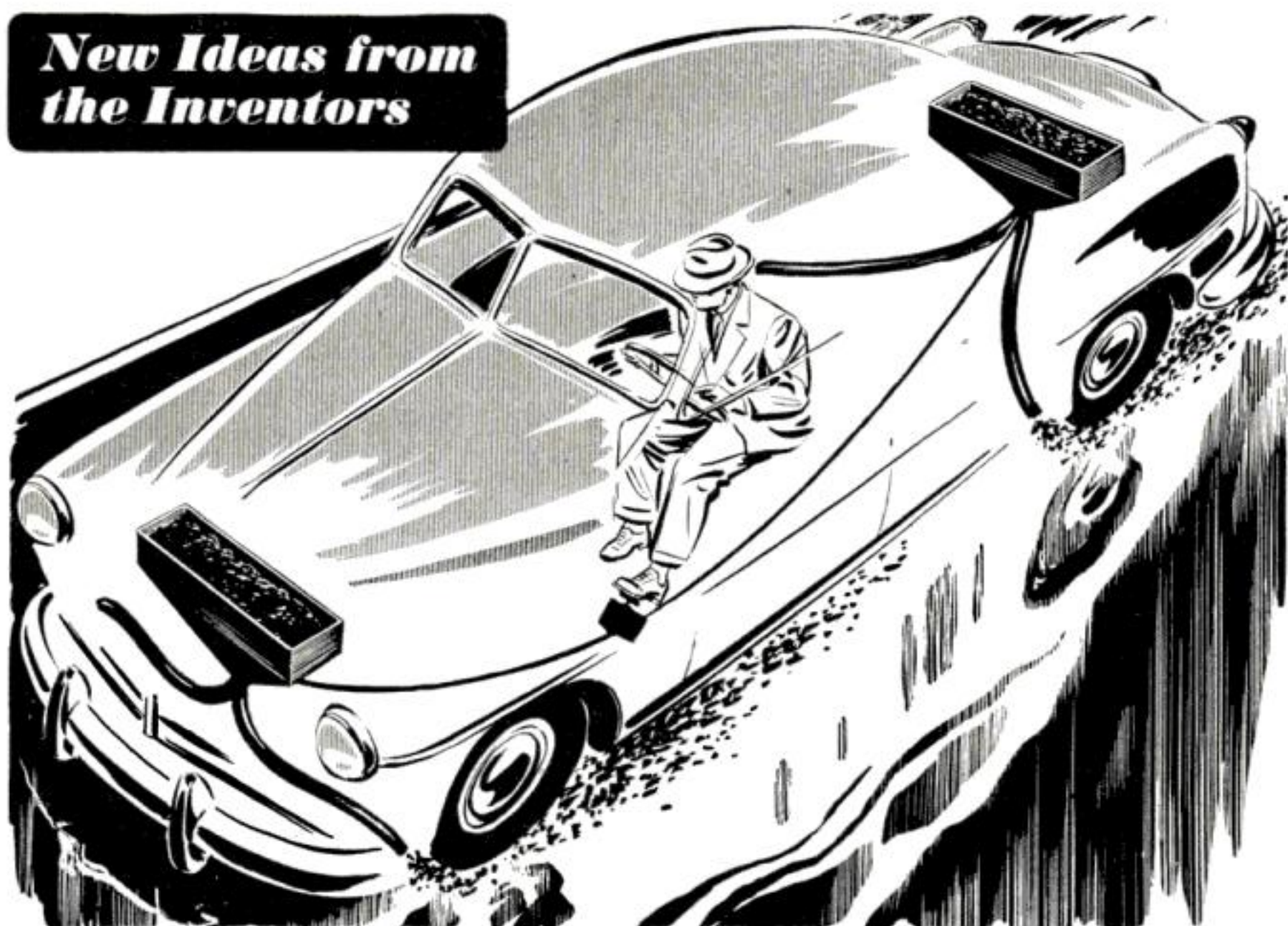


Large-scale plants, like Oak Ridge establishment, satisfactorily dispose of short-lived radioactive waste by burying it in trenches on special grounds with guards and locked gate. But this is no answer to problem of getting rid of materials whose radioactivity lasts many years.



Proposed scheme for future big-scale operations is to use unwanted radioactive liquids as part of water in making huge concrete blocks that would be sunk in mid-ocean. Precedent is postwar disposal of unused poison gas by scuttling shipfuls of shells and bombs at sea.

New Ideas from the Inventors

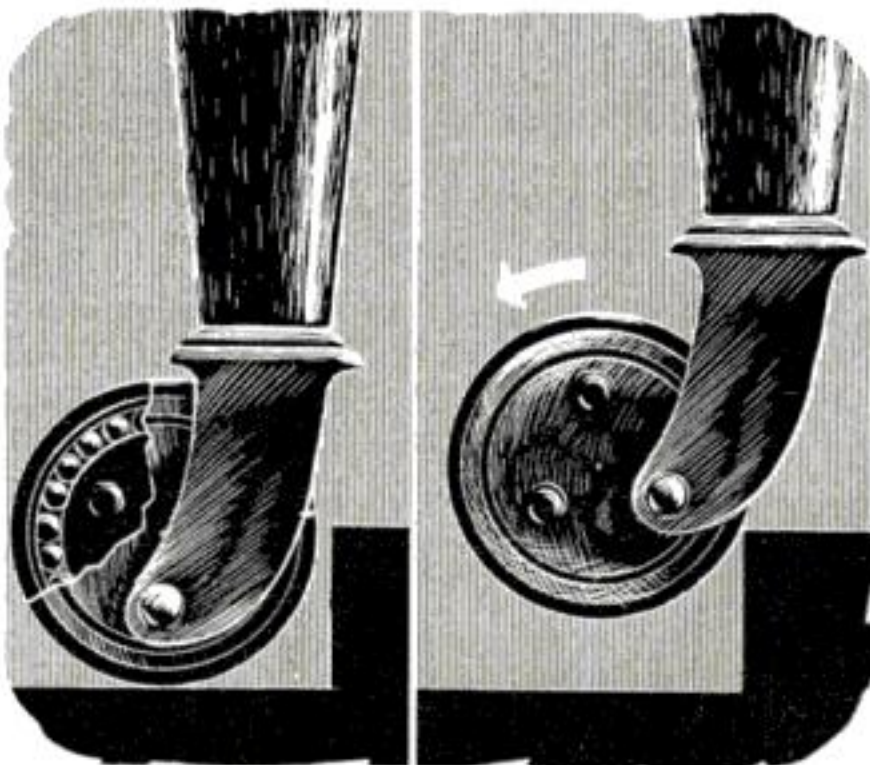


Sand Prevents Skidding. Getting your car out of snowdrifts and controlling skids on ice might be a lot easier with the sanding device invented by J. U. Richard, of Montreal, Canada. Sand is sprayed under

the wheels through pipes from two hoppers, one under the hood and the other in the trunk. A foot pedal near the driver is connected by flexible cables to valves in the hoppers, releasing sand when pressed down.



Magnet Holds Can Lid. You wouldn't have to poke your fingers down inside a can to fish out its lid if you had cut it out with this can opener. A small permanent magnet fixed to the top of the crank-type opener holds the lid after it has been cut off and keeps it from falling in. The device was invented by J. Webb, of Toledo, O.

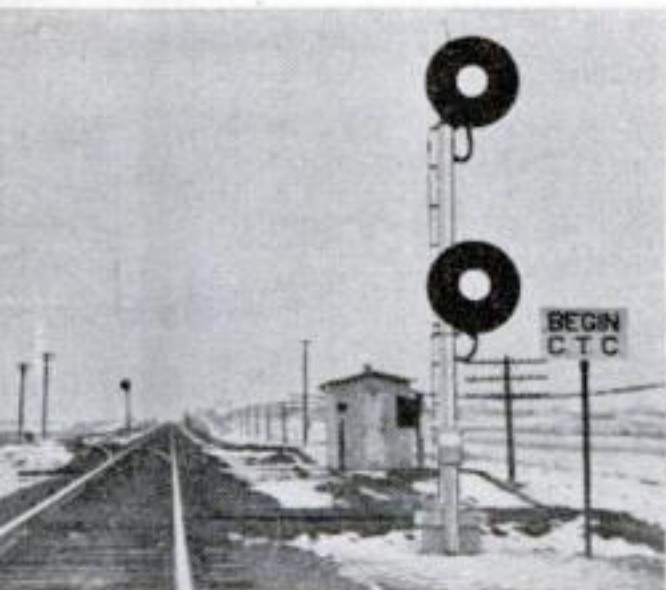


Caster Smooths Bumps. When this off-center caster meets an obstacle, such as a threshold, its pivot point, normally at the bottom of the wheel, is pushed around to the top. This increases its height and helps it to get over the bump. On the level, only the rim revolves on its bearings. The inventor is E. J. Casper, of Vallejo, Calif.

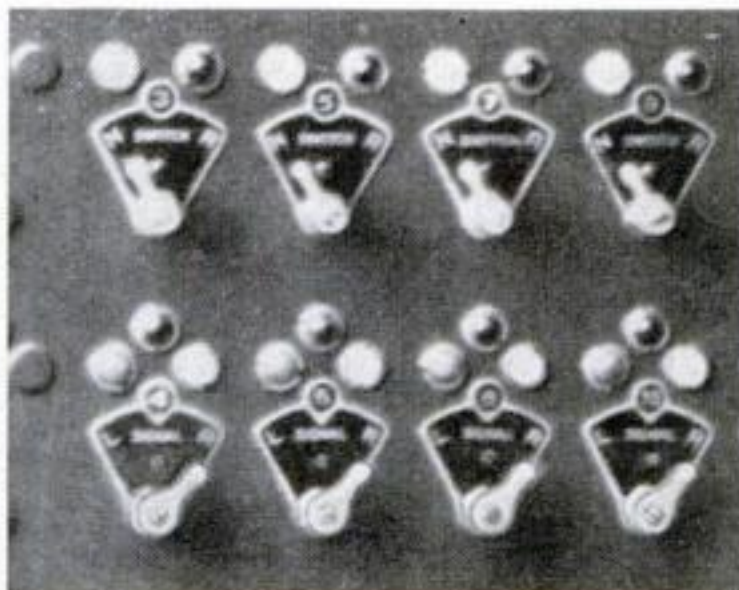


This series of photos shows operation of a Union C.T.C. board. Dispatcher first turns upper lever to change position of a track switch. Next he sets lever for signal indication at

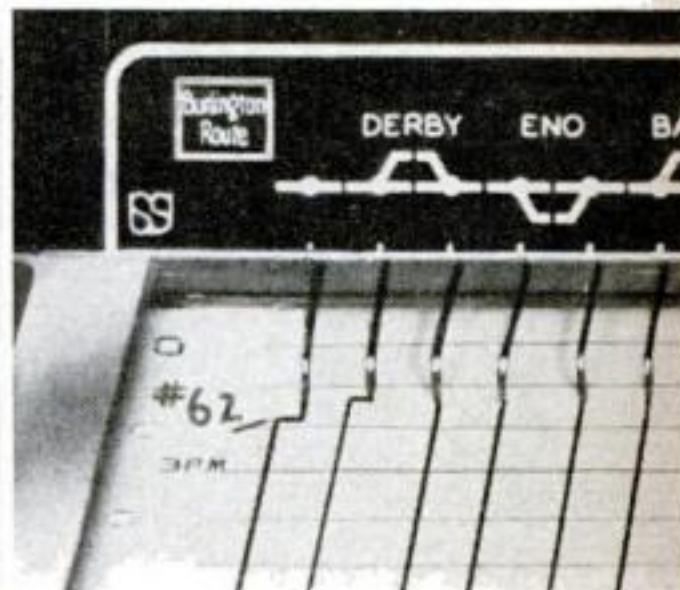
switch location. When he then pushes button as shown at right, code signal goes out on wires to trackside mechanism tuned to receive it at C.T.C. location such as shown at left below.



Here signals are set to inform engineer of an approaching train that switch has been thrown for him to go into a siding. Also, the code goes back along the wires to the C.T.C. control



panel, changing indication lights (center, above) to tell the dispatcher that his orders have been carried out. At right is a series of pens automatically recording the progress of trains.



the dispatcher "talks" to the engineer through trackside semaphores or light signals—and can shift his "orders" from minute to minute according to conditions up ahead.

Boiled down, C.T.C. is a combination of almost all the automatic gadgets that have proved their worth in railroading. It brings into the dispatcher's office electrical reports on the position of all switches and signals, and notes electrically the movement of each train past control points spaced along the tracks. In turn, lights and signals are controlled by his switchboard, so that he can shunt trains about like models with a flick

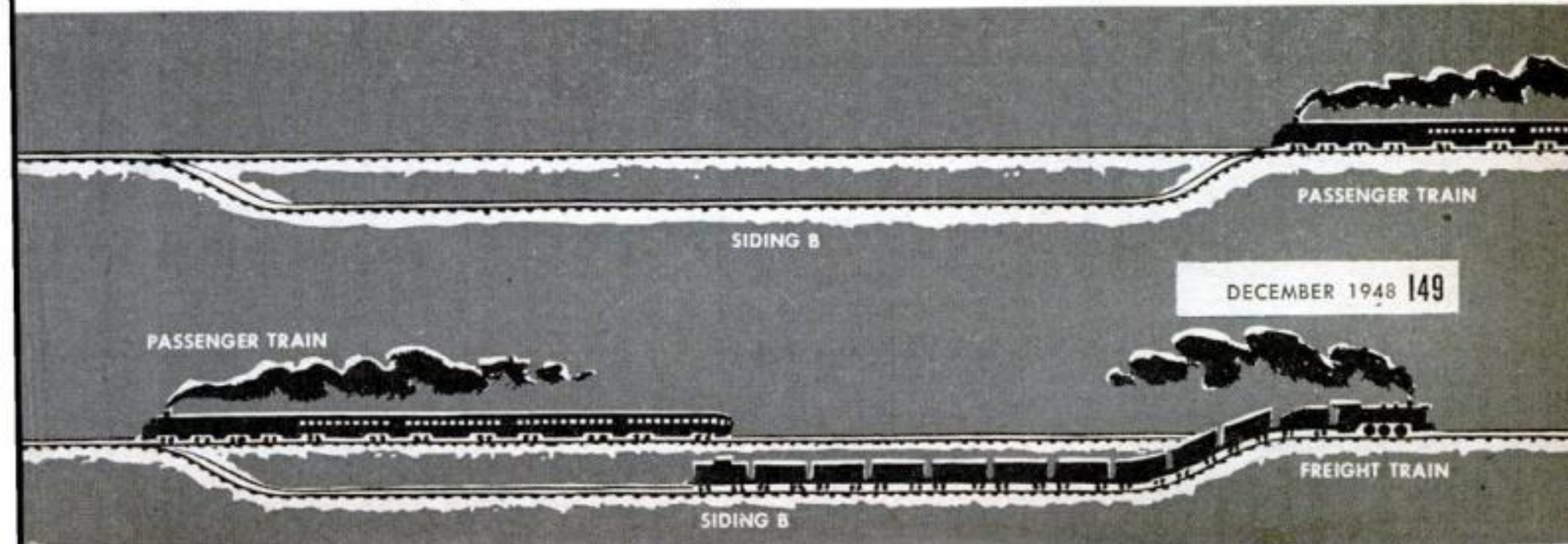
of a few levers and the touch of a couple of buttons.

While you're reading this, some 350 men, seated before C.T.C. panels at spots along more than 9,000 miles of track on 50 different railroads, are directing operations of up to 1,000 trains.

In one Pere Marquette division installation the dispatcher controls a loudspeaker linked to a trackside microphone 40 miles away. When his panel lights tell him a train is approaching the location, he turns the microphone on by snapping a switch. The mike picks up the roar of locomotive

siding B, actually many miles away. Bottom sketch shows freight train pulled into siding B to let express pass. In this case the timing was so exact that the freight was then able to pull

out of the siding without stopping. Without C.T.C. coordination, the freight train would have been delayed at least an hour on siding A. System was developed by Union Switch & Signal Co.



exhausts as the train puffs up a stiff grade. By timing the exhausts, he can tell how fast the train is moving. Thus he knows how long it will take to reach the next siding, where it can be shoved off the single-track main line to make way for another train.

With C.T.C. it is possible—and it is done regularly every day—to send a freight train into a siding to permit a fast passenger train

to pass, and then bring the freight back onto the main line again—without stopping either train.

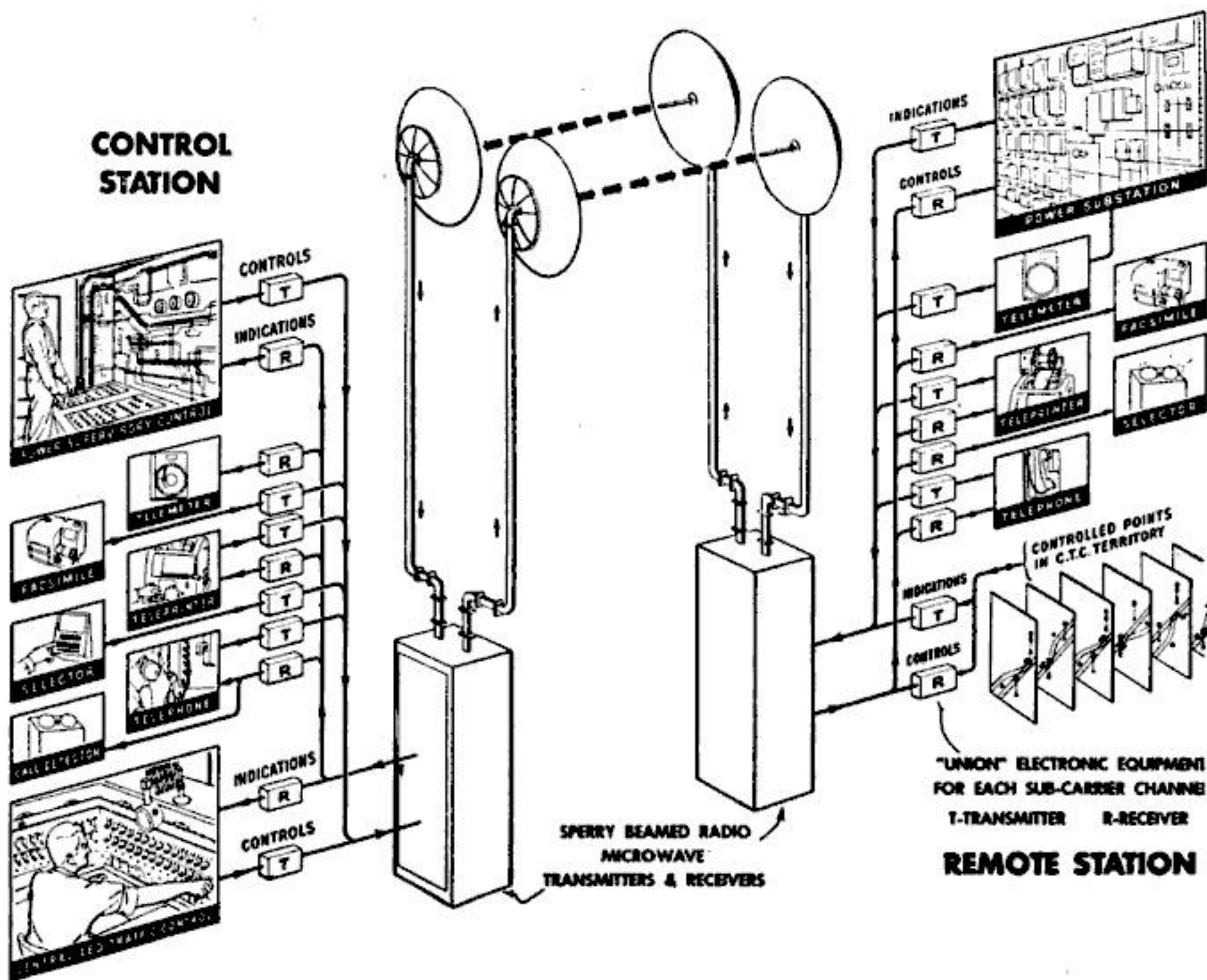
The longest continuous C.T.C. setup right now is the Burlington's 480 miles between Lincoln, Neb., and Denver, Colo. Nearing completion, however, is a 600-mile stretch on the Seaboard between Richmond, Va., and Jacksonville, Fla.

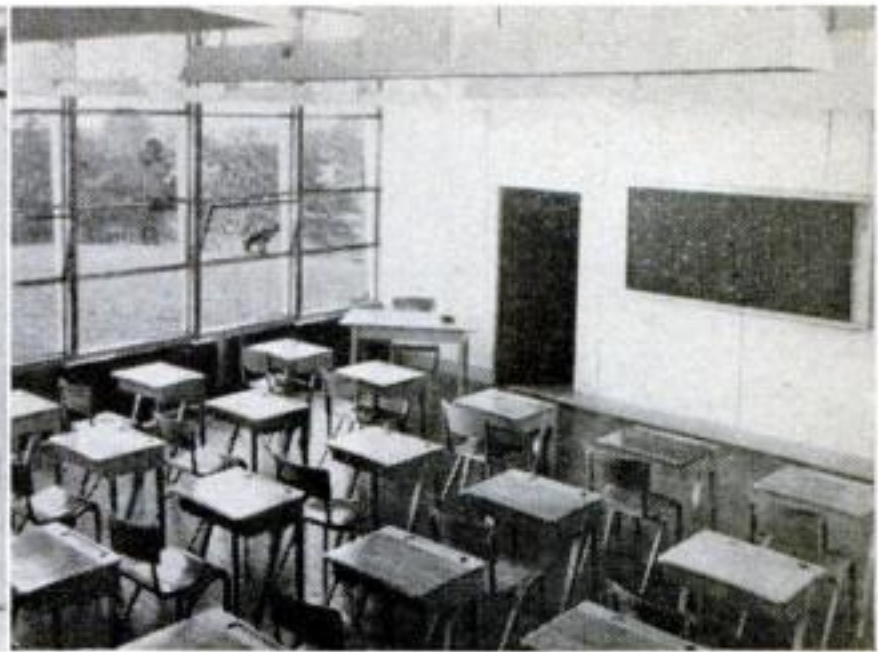
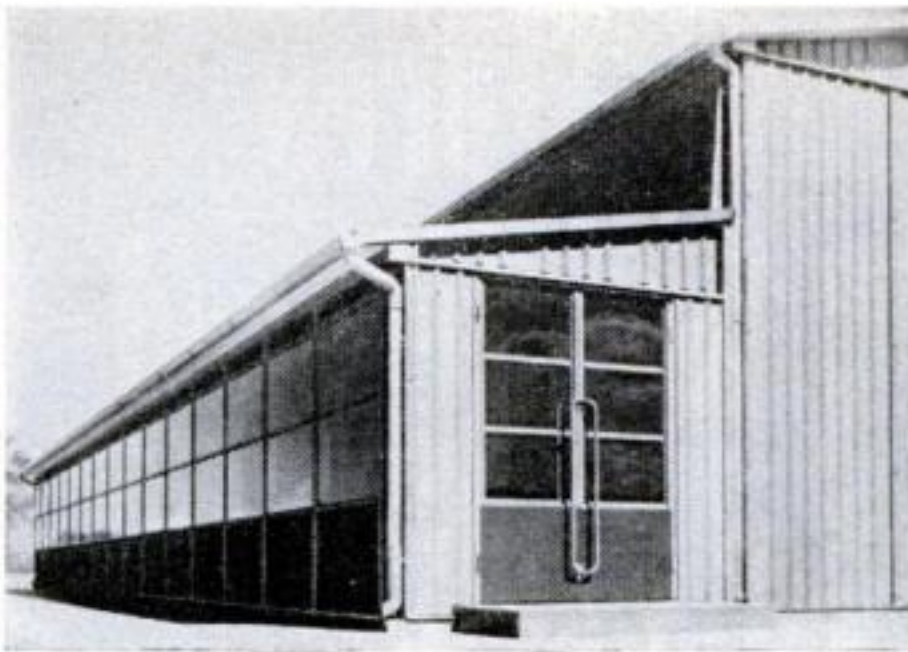
Radio Beams Work on the Railroad

MICROWAVES may one day replace wires in the operation of Centralized Traffic Control (C.T.C.) switches and signals. They are in line, too, to handle the remote control of power substations and railroad communications such as teletype, telephone, and facsimile reproduction of written orders and messages.

These pencil-like beams of radio energy are already on these jobs at an experimental installation on the Long Island Rail Road between the Jamaica and Floral Park stations, a distance of six miles. The system

was developed in collaboration with the Sperry Gyroscope Co. and the Union Switch & Signal Co. Two parabolic reflectors, each four feet in diameter, are installed 100 feet above the ground at each station. One reflector is used for transmission and the other for the reception of signals. Since microwaves follow the line of sight, relays and repeater stations would be needed to extend operation of the system over any great distance. The diagram below shows the relationship between control and remote stations in a typical setup of this system.





From Planes to Schools

PREFABRICATED schoolhouses, built mostly of aluminum, are being turned out by Britain's Bristol Airplane Co., to meet the shortage of adequate school buildings. The

exterior view shows the generous window space. Walls and roofs are insulated for warmth in winter and coolness in summer. A unit construction system permits a choice of several different layouts. Erection is simple, can be done entirely by local labor.



Pick Your Own Music

You don't need to know music to play an accompaniment on the Robo-Chord[®] illustrated here. You play chords that sound much like those of a harp by simply sliding a pick across horizontal bars. These are keyed by letters and numbers to specially prepared sheet music. As the pick glides across, it sinks into depressions along the bar, and its plastic point plucks the proper strings to produce the desired chord. Fourteen chords are available in one setup, but substitute bars allow for a variation of 79 chords. At the front of the instrument is a silencer bar. This can be manipulated by the right forearm, enabling the instrument to be played with one hand. A second pick can be used by the left hand, making possible the performance of extremely fast passages. The Robo-Chord, invented by Kermit Bowen, La Mesa, Calif., musician, will be made in three sizes, priced at \$10 to \$35.



Recordings Trap Rats

A NOVEL method of destroying rats has been developed by James G. Anderson, who runs a pest-exterminating business in Vancouver, B. C. As shown above, he records a rat's squeals. When an amplified recording is played back near a rat hole, he claims, the rodents are scared stiff and scurry out. Mr. Anderson then shoots them.



New Stores Offer Metered Air Cooling

Central plant air-conditions business buildings spread out over 16-acre shopping center. Individual meters tell how much each tenant should be charged for his "cold."

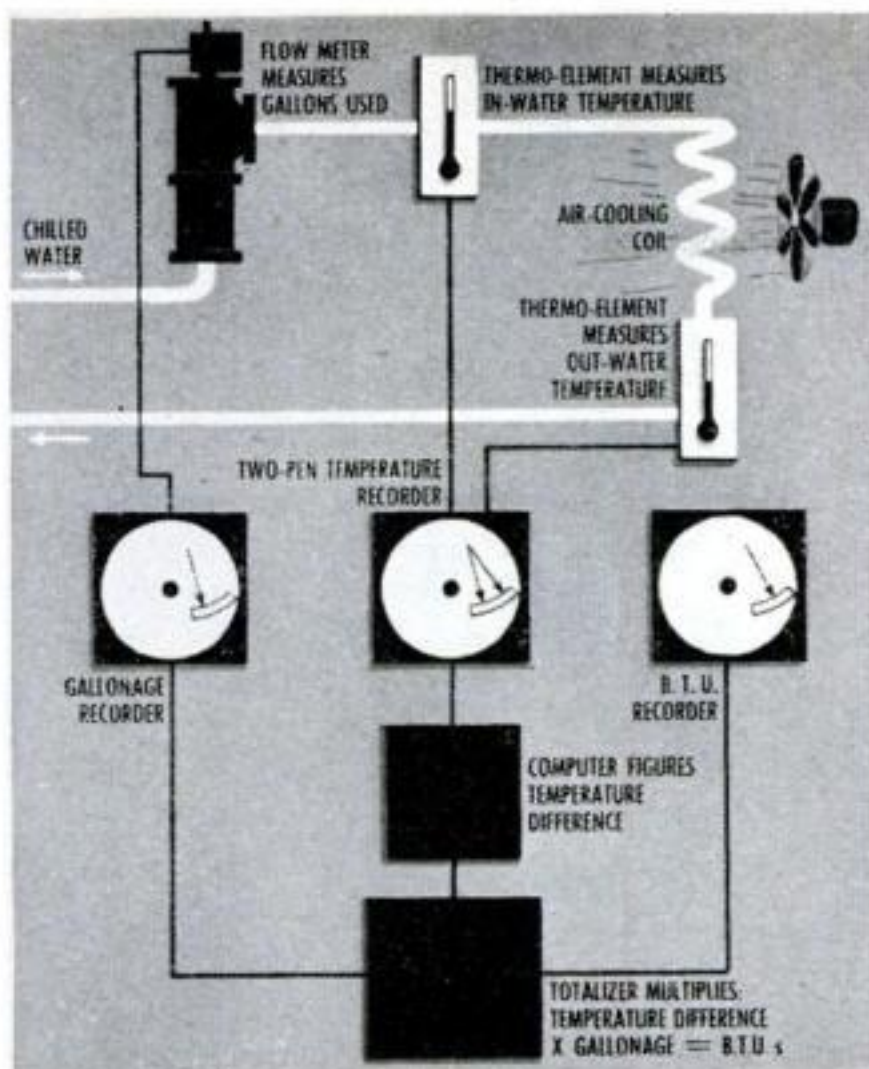
PIPED air conditioning, supplied and billed just like cooking gas, will cool the business buildings of a new housing development on Long Island. The stores, offices, theaters, and restaurants in the 16-acre shopping center (shown in color in model above) will get their air conditioning from a central plant that is more than a mile away. This is believed to be the world's first installation of its kind.

The plant containing the air conditioning compressors will also furnish steam heat to the entire 170-acre development, which will house 10,000 people. One man at the control board in the steam plant will be able to set the winter temperature and humidity in any apartment or store.

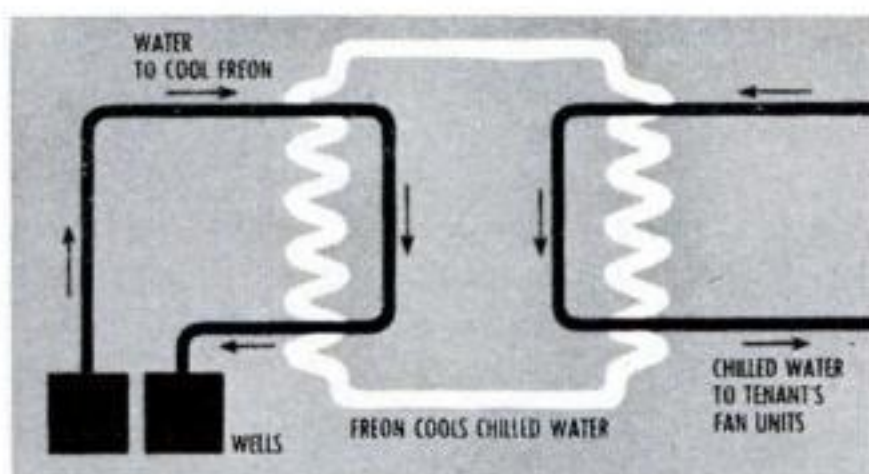
Air conditioning will be available only

to the business section. Individual fans for each business tenant will force air over coils containing chilled water, right on his own premises. The water is to be chilled by compressors at the central plant and distributed through a mile-long pipe under a 100-lb. pressure. To cool the compressors themselves, water drawn from wells will be used. So much will be required that it cannot be discharged into the sewers after use, but must be forced back into the ground in another set of wells to keep from lowering the underground water level.

How to charge the tenants for the air conditioning each uses was a problem until the engineering firm of Meyer, Strong, and Jones, which designed the installation, devised a meter to tell exactly how much



Novel meter, shown schematically above, tells how much air conditioning each tenant uses. Thus "cold" is billed like electricity or gas.



Central plant uses freon to chill water, which is pumped a mile to buildings. Water from wells cools freon, then is forced back into ground.

cold is supplied to each of the customers.

This air-conditioning meter is really four meters. One meter will measure how many gallons of chilled water run through the tenant's cooling unit. Two others will measure the temperature of the water—one before it enters the customer's cooling unit, the other after it leaves. An electronic computer will do the subtraction to figure the temperature difference. Then the totalizer will multiply this difference by the number of gallons given by the flow meter. The answer—the amount of heat added in BTUs—will show on the fourth meter.

The project, called Fresh Meadows, is being built by the New York Life Insurance Co. from plans drawn by Voorhees, Walker, Foley, and Smith. **END**



Plastic Stands Heat

COLORFUL and crystal-clear plastics that won't curl up even in boiling water—as shown in comparison test above—will soon be available at the same price as materials that do not resist heat. The new polystyrene, developed by the Koppers Co., is intended for combs, tableware, kitchen utensils, and radio cabinets.

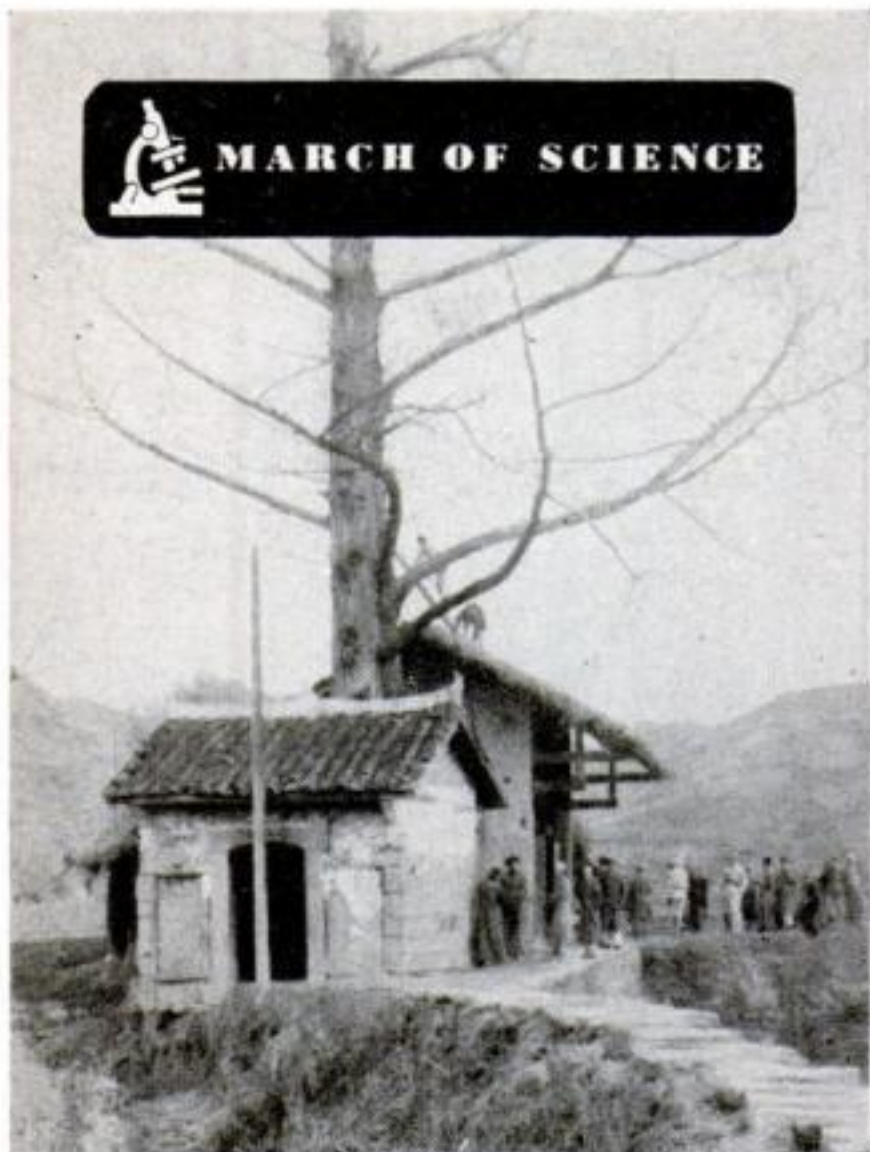


Salty Tire Grips Ice

SALT is the tire engineer's latest prescription for quick stops on winter roads. A new recapping material called Wintrac[®], developed by U. S. Rubber, has tiny salt crystals imbedded in it. As the rubber wears, the crystals drop out, leaving large pores that grip icy roads to shorten stops and prevent skids.



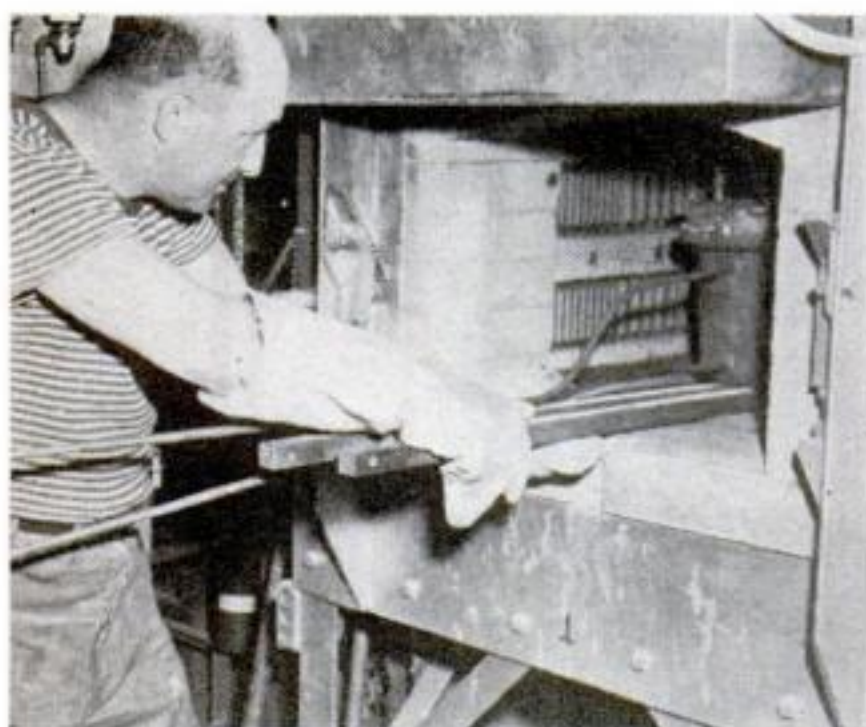
MARCH OF SCIENCE



"Fossil Tree" Found Alive. Students of prehistoric plants compare the discovery of this tree, a dawn redwood, to finding a living dinosaur. A University of California scientist recently found several hundred growing in China. They belong to a race previously believed to have died out 20,000,000 years ago and known only as fossils.



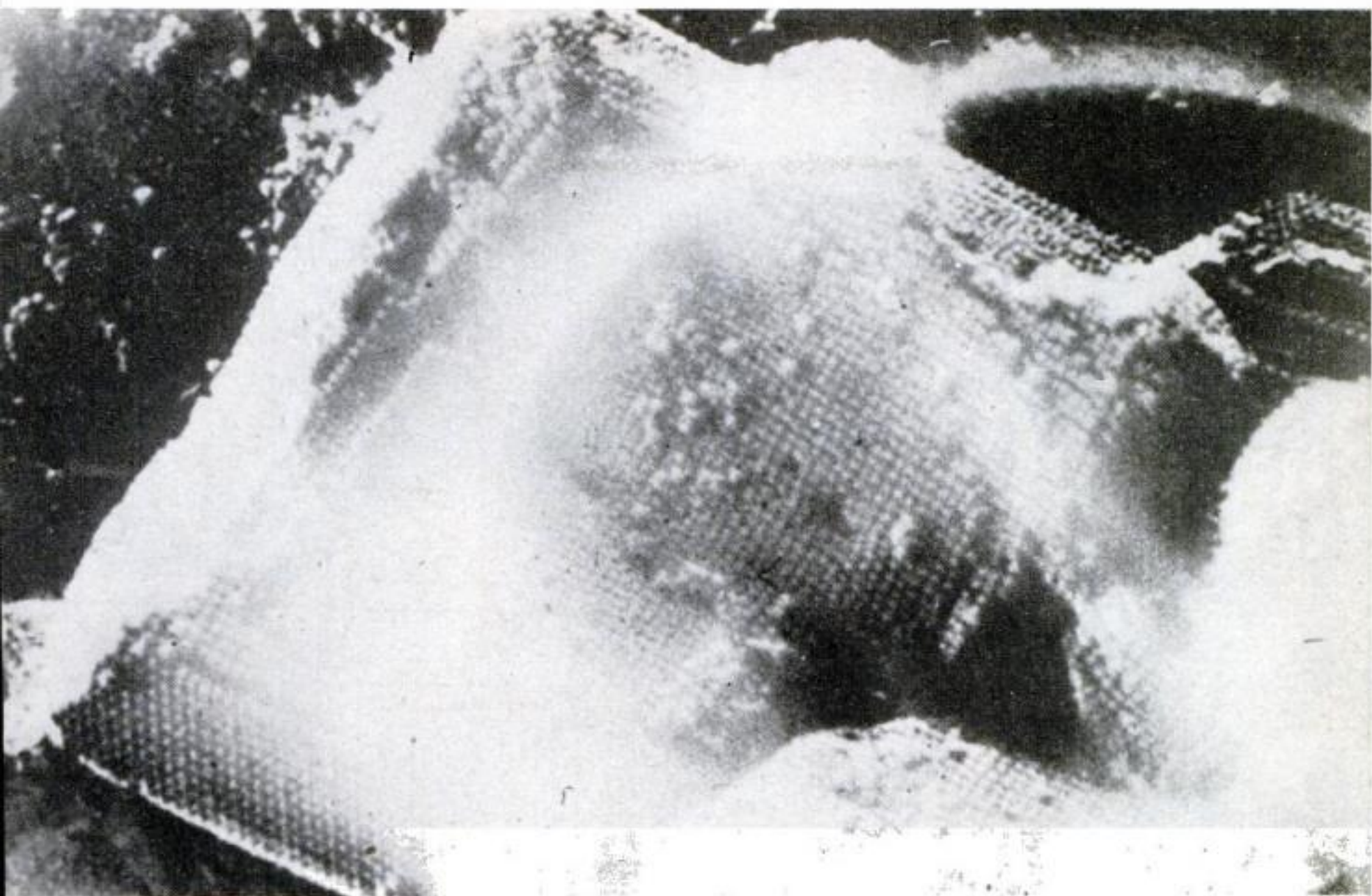
"Black Light" Tests Eggs. To test eggs even more quickly than by candling, just turn an ultraviolet lamp on them as shown above. Its invisible rays, Westinghouse has found, make fresh eggs glow scarlet, while eggs 8 to 10 days old show up purple. The difference in fluorescence comes from oxidation of the shells.



U. S. Taps Nazi Secret. This Navy technician is cooking a batch of iron and nickel to make "permenorm." It is a new alloy, useful because it magnetizes quickly. Developed in Germany, it has been duplicated from captured samples. It may be used in rectifiers for changing AC to DC and in rugged amplifiers to replace electronic tubes.

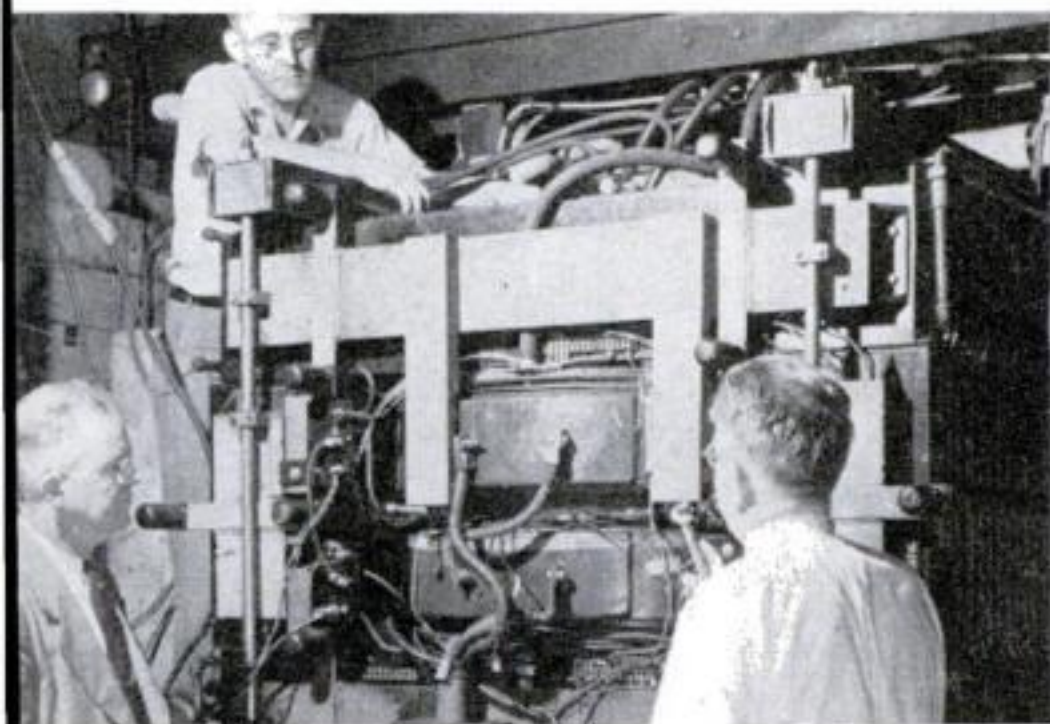


Meter Feels Thickness. This gauge measures electrically the thickness of lacquer deposited on engine pistons by lubricating oil. An operator hooks one high-voltage terminal to a piston, touches the other to the lacquer—and notes the voltage needed to burn through it. The Texas Co. developed the gauge for research.

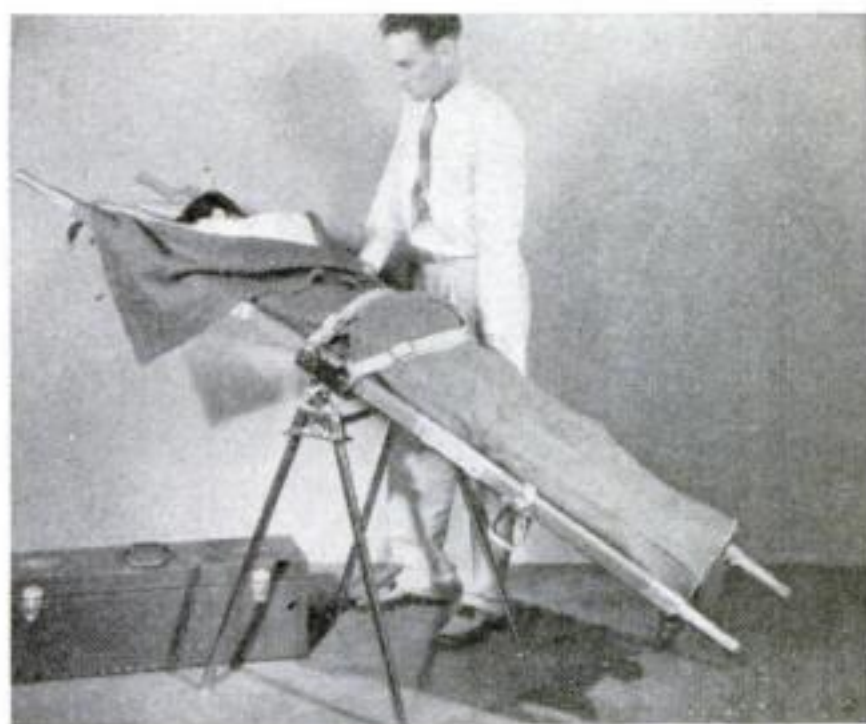


Molecules Sit for Portrait. Each white dot neatly lined up in this picture is a single molecule. The white gauzelike object formed by their ranks is a crystal of tobacco necrosis virus protein. The stray dots are

molecules of partly crystallized protein. The smallest bit of matter ever photographed, each molecule is about $4/10,000$ in. in diameter. They posed for an electron microscope at the National Institute of Health.

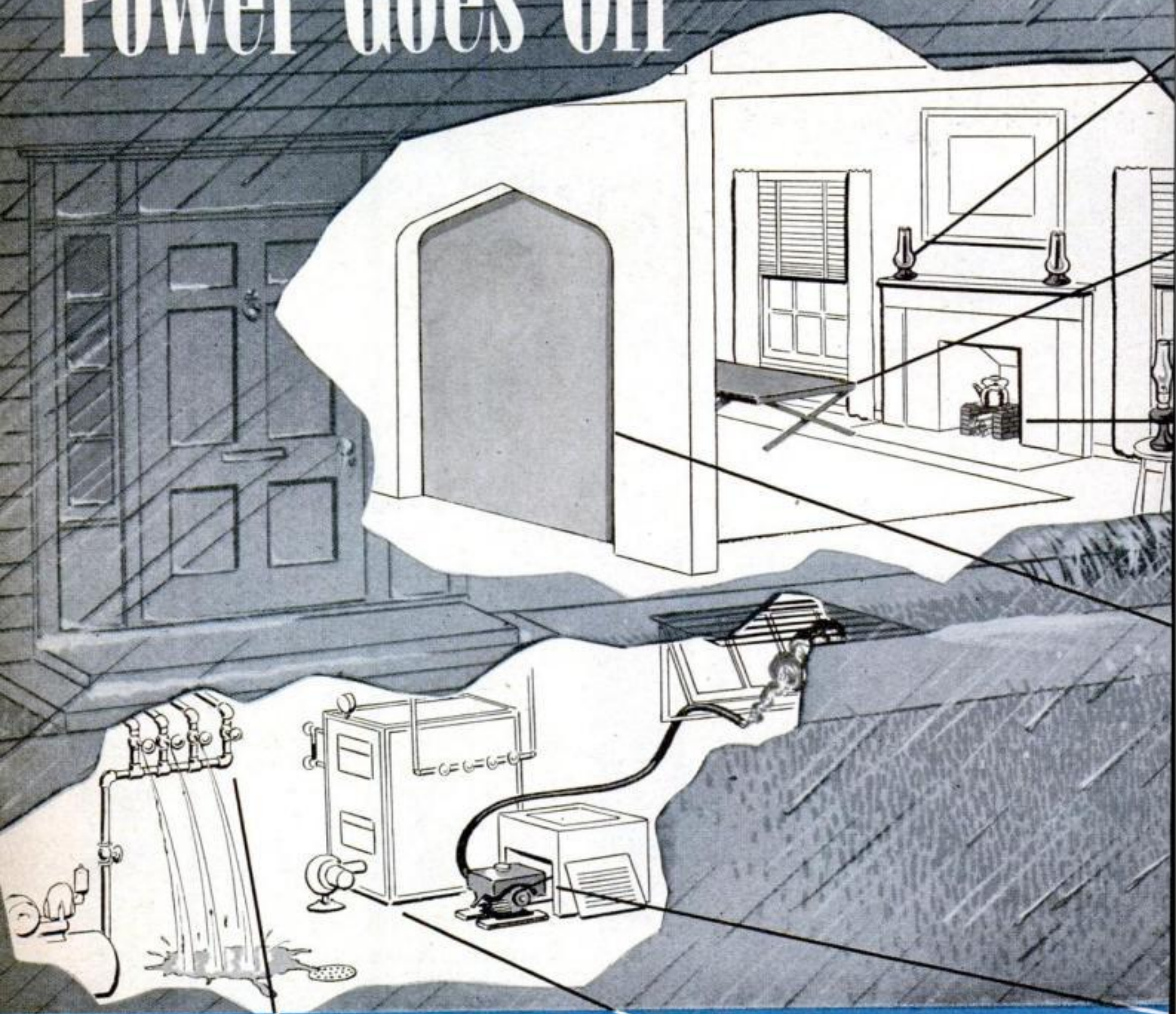


Biggest Medical Betatron. Initially used in biological research at Union College, Schenectady, N.Y., the 50,000,000-volt GE betatron above may find future application in treating cancer. It can be tilted to direct its beam toward a patient from any angle, and thus yields the most powerful X rays ever available for therapy.



Rocker Aids Rescues. The folding, portable Rocking-Resuscitator® above takes the guesswork out of the Eve method of artificial respiration (PS, July '46, p. 103). A tilt indicator on the base enables an operator to follow exactly the sequence of angles at which a victim is seesawed to drain his lungs and revive breathing.

How to Get Along When the Power Goes Off



If the weather is below freezing, drain the water and heating pipes in the part of the house you are not heating and using.

If your coal furnace has been converted to oil with a gun type of burner, improvise a grate and burn wood or cannel coal in it.



Prepare now for light. Stock up on candles and buy a few kerosene lamps. Candles burn best in shields.

Set up cots for sleeping in the living room. If you have no cots, put mattresses from beds on the floor.

Your fireplace can be used for heating and cooking. If you have no grate, improvise one of bricks.

Don't try to heat the entire house. Limit your living quarters to a few rooms and close off the rest.

The gasoline engine from your power mower can substitute for the electric motor on any one of a number of appliances.

There are survival techniques for householders as well as explorers. You can be comfortable without utilities—if you know the tricks.

By George H. Waltz, Jr.

JUST about everything in our modern all-electric homes responds to the flick of a switch. This kind of push-button living is fine—as long as there's power behind the push buttons.

Without electric power—and a break in a single wire can knock it out—our ultra-electric households become more old-fashioned than Grandpa's weatherbeaten farmhouse. There a wood stove, kerosene lamps, and a hand-pumped well provided at least the minimum comforts of home.

What would your home be like if your electricity suddenly was cut off for an extended period?

No light, no heat if you have anything but a hand-fired coal furnace, no radio, no refrigerator unless yours is a gas job, no home freezer, no electric clocks, no appliances, no water if you depend on your own deep well, and no means of cooking if you are modern enough to own an electric stove.

Without electricity, you would immediately be reduced to Grandpa's standard of living, but without the simple equipment and know-how that Grandpa had for maintaining a livable non-electric home.

That is, unless you were prepared. Fortunately, preparedness doesn't cost much.

Many Caught Unprepared

Last winter, ice-laden trees crashing down on power lines not many miles from New York City kept parts of one large suburban community without electricity for 11 days. Many families, caught unprepared, had to leave their streamlined, automatic homes to sleep in hotels, armories, and school gymnasiums.

But the handy men of the community, exercising their home-workshop ingenuity, kept their families—and in many cases their neighbors'—reasonably comfortable and well fed by improvised emergency methods.

The most complete and most obvious insurance against a power failure, of course, is a small 120-volt AC gas-engine-generator unit. Kept as a stand-by, it can be connected to the home lighting system easily and quickly at the fuse box (after the master

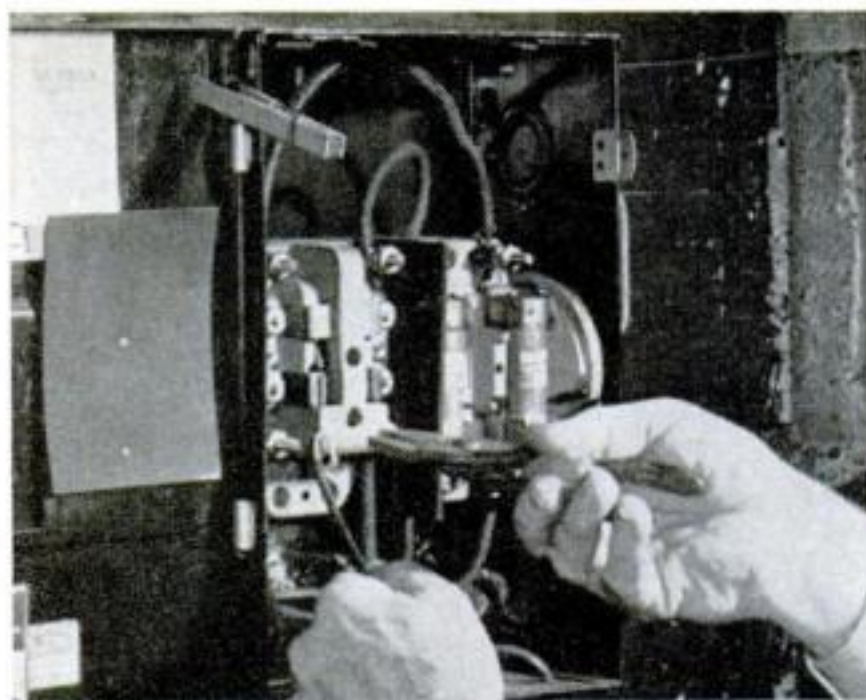


Portable gasoline-engine generator is the ideal insurance against power failures. John Osterberg, of Summit, N. J., keeps this 120-volt, 60-cycle, 2,500-watt unit ready for emergencies.

switch has been pulled and left open) and it will provide ample power for such essentials as an oil burner or coal stoker, a refrigerator, and a few lamps.

Although generator sets are relatively expensive—the cheapest large enough to supply a minimum of 120-volt current for emergency home use costs about \$120—many homeowners living in isolated sections have found them to be more than worth the investment. In some localities, neighbors have banded together and chipped in to buy a generator unit large enough to supply the essential emergency electrical needs of two or three homes. Figured on such a community basis, the individual investment is not high.

During any extended power failure, no



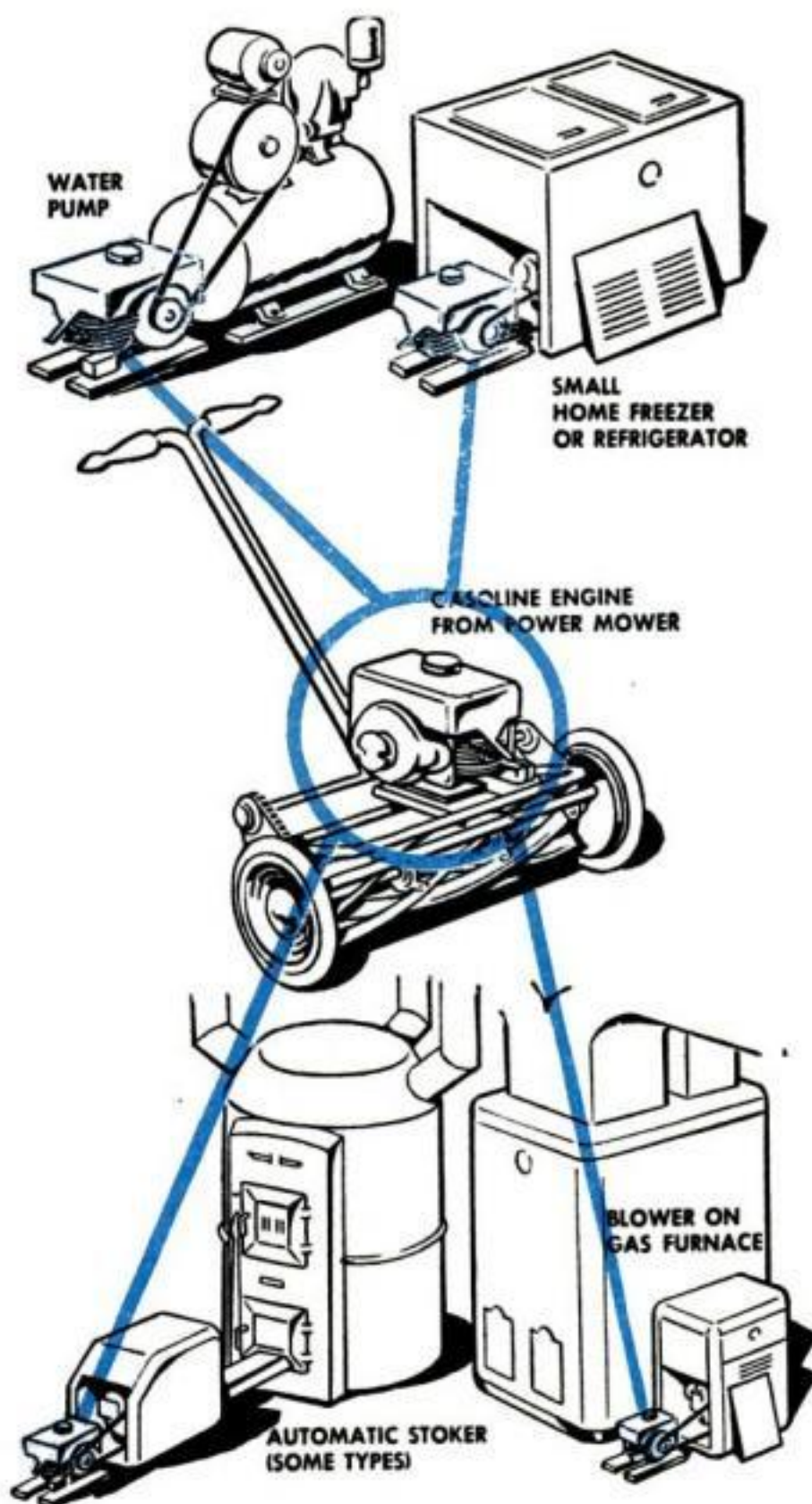
The power leads from the portable generator are connected into the house lighting circuit at the fuse box. The master switch is pulled and left open as long as the unit is connected.



Osterberg checks operation of his generator's voltage-regulating system with a voltmeter. Voltage must be controlled to avoid burning out bulbs and injuring electrical appliances.

home workshopper who owns a car need be without electricity—not with 100 horsepower or more parked in the family garage. By permanently jacking up one rear wheel and using a tireless rim on the wheel as a pulley, it is not difficult to rig up a belt drive for an AC generator. Commercial power take-offs for automobiles also are available (PS, Oct. '46, p. 208). On these it is necessary only to back one of the car's rear wheels up on a ramp. A built-in roller, rotated by the rear wheel, then drives a power-take-off pulley.

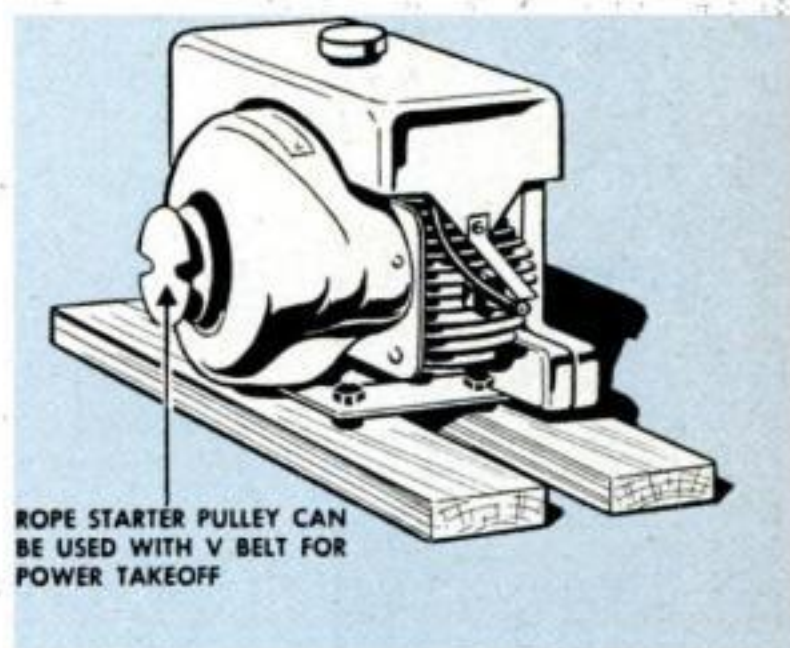
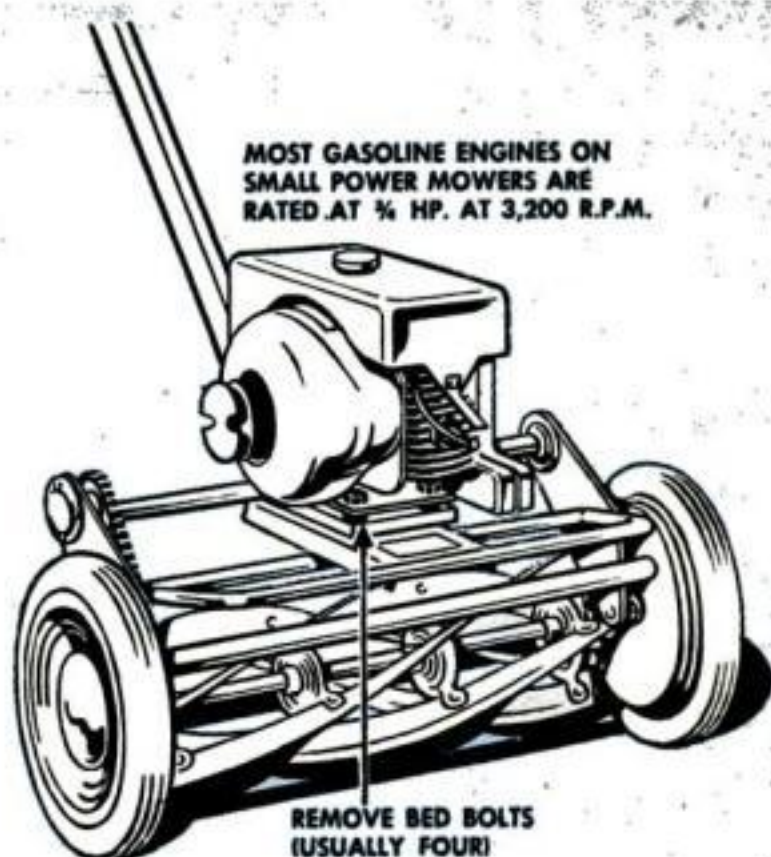
But even without a home generator, lack of electric power need not completely disrupt a household. There are endless make-shift measures than can be taken to provide the four main essentials for living—heat,



If you own a power mower, its gasoline engine can be put to work in the house. With proper pulley setup, it can drive water pump, refrigerator, coal stoker, or gas-furnace blower.

light, water, and some way to cook a meal.

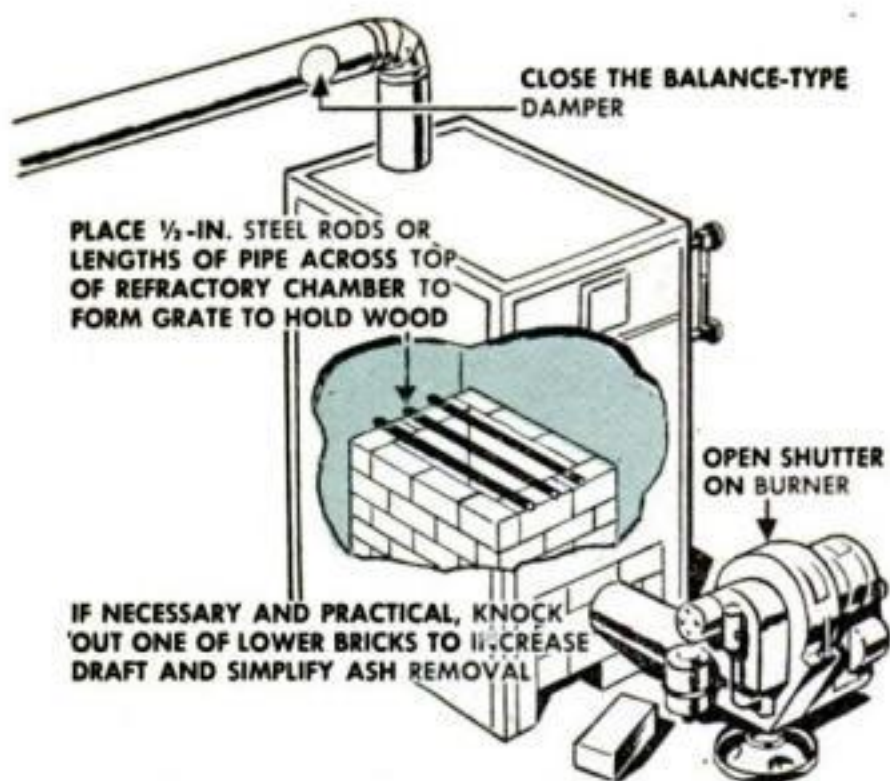
When the power fails during the winter, the first and most important problem is to keep your family warm. If you are still hand-firing a coal furnace, you have no problem. Coal stokers and oil burners require electricity, but a gas furnace can be run without it. The electric thermostat can be cut out of the system and the gas turned on by hand and run for short periods, even though the blower—if the furnace has one—will not operate. If yours is a gas furnace, get the information on its *manual* operation from your local gas company *now*. More than one householder has let his family shiver because he didn't know that he could start up his gas furnace without a flick of a switch.



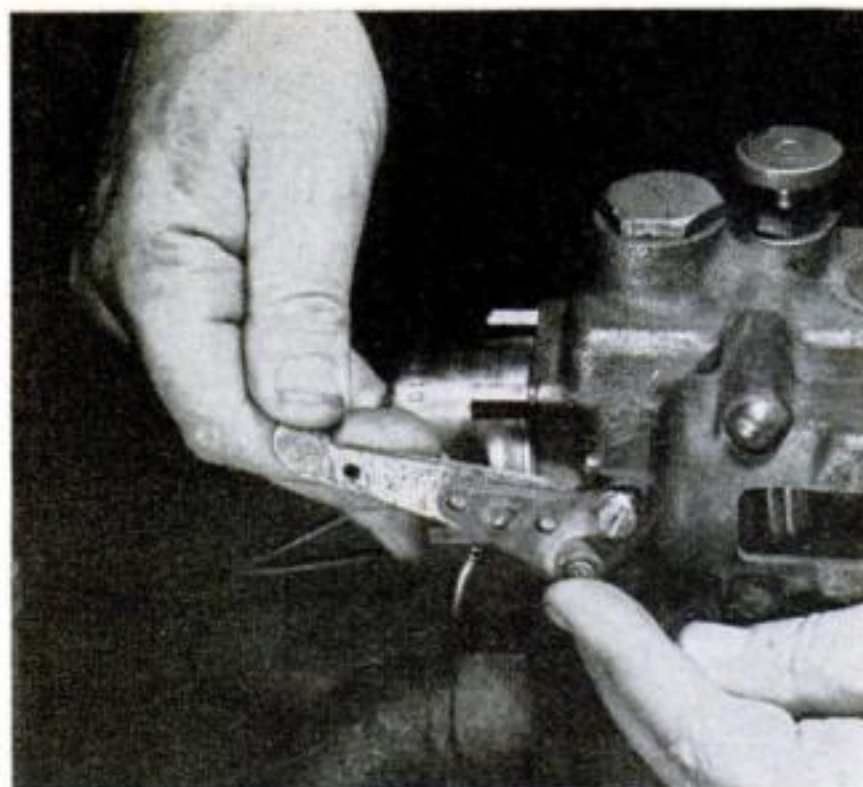
Remove the gasoline engine from the mower by loosening the bed bolts. Then mount it on two 2-by-4s, so that it can be anchored to a column or other mooring with a large C clamp.

On a furnace converted from coal to oil, with a gun-type blower, emergency heat can be obtained in several ways. One is to pull back the burner and insert the torch of a portable kerosene weed burner in the ash-pit opening. It'll be noisy, inefficient, and need constant supervision, but it will heat up a small furnace.

If the power failure promises to last more than a few hours, it's probably best to convert temporarily to solid fuels. Laying $\frac{1}{2}$ -in. steel rods or pipe across the top of the combustion chamber makes a grate on which wood can readily be burned. To get the increased draft necessary, just wire the balance-type damper on the furnace flue closed and open the shutter vents on the blower. For additional draft, and to provide



A coal furnace that has been converted to oil with a gun-type unit can be altered to burn wood by installing an improvised grate and closing the damper on the furnace flue.



A gas furnace can be turned on and operated manually, even though power failure has made the thermostat inoperative. Check your gas company ahead of time to find out how yours works.

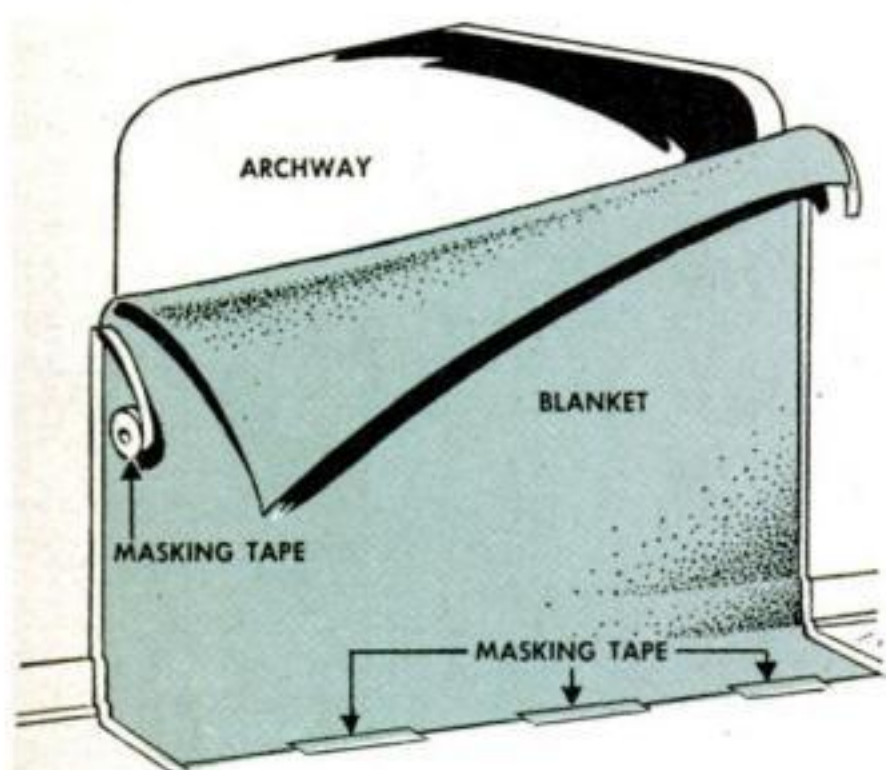
an easy means of removing the ashes, simply knock loose one refractory brick at the base of the furnace at the ash door.

If you have a rotary-type conversion or a unit oil burner (not a conversion), however, your central heater will have to remain shut down until you can get electrical power. There is just no safe and simple way to operate them without electricity.

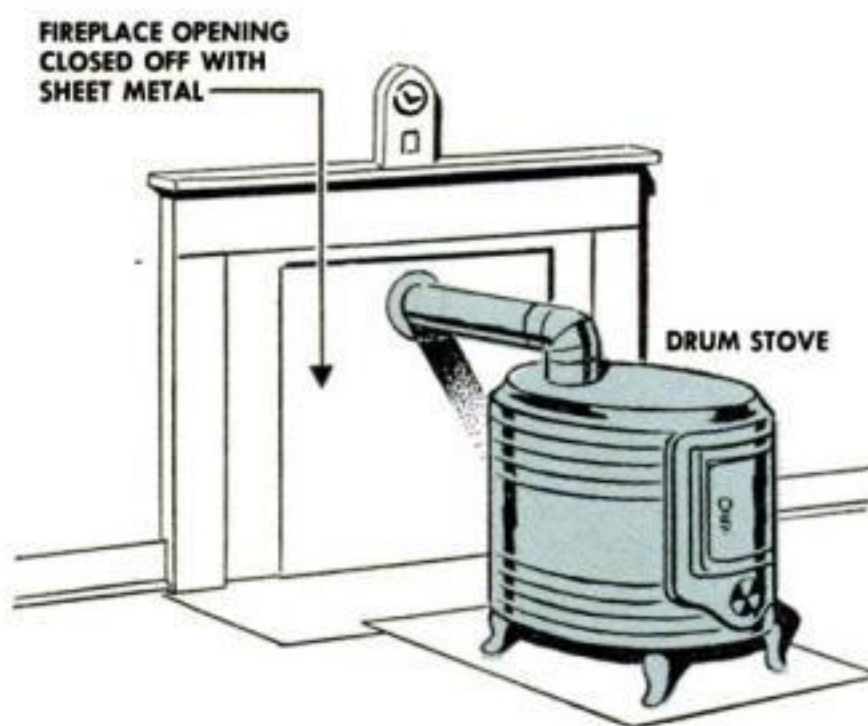
If your home is heated by an automatic hot-water furnace, there is one dodge that will help out—provided you're prepared in advance. That is to have a coal-fired laundry stove or pot stove set up so that it can be

valved into the heating circuit. Installing this rig calls for plumbing savvy, though, and it isn't a job you can tackle after the juice fails. Also, don't forget that if the hot-water system uses an electrical circulator, you'll have to drive this pump from some external power source.

Some automatic stokers, particularly stokers that have been added to conventional coal furnaces, can be operated successfully if you have a suitable power source, such as a portable gasoline engine, to drive the blower and turn the screw that feeds in the coal. The gas engine from a power lawn mower



Close off the part of the house you are not using. Doorless doorways, archways, and stair wells can be sealed effectively by covering them with blankets held in place by masking tape.



In an extended emergency, close your fireplace with sheet metal and install a drum or pot stove. Fueled with wood or chunk coal, it will provide enough heat for several rooms.

will do the job nicely. Most lawn-mower engines are rated at at least $\frac{3}{4}$ hp., which is ample. Remove the engine from the mower frame by loosening the bed bolts and then mount it on 2-by-4s. The entire unit can be anchored to the floor by clamping it to the base of a column or other convenient mooring. Flexible tubing must, of course, be used to carry the engine's deadly exhaust gases safely out of doors.

If the gas engine has no separate pulley for power take-off, the rope-starter pulley can be used as a drive pulley for a V belt. The main problem is to adjust whatever pulley system you use to provide the correct speed for the stoker mechanism. If the speed of the gas engine is twice that required by the stoker, for instance, the driven pulley on the stoker must be twice as large as the driving pulley on the engine.

The engine from your power mower can be harnessed to do a good many other different chores during an emergency. With the proper pulley setup to run an appliance at the right speed, it can be used to drive a water pump, the blower on a gas furnace, a refrigerator, or a small home-freezer unit. Remember, however, that when a gasoline engine is used for power, control of the appliance is manual. Since the electric thermostats and aquastats will not be an operating part of the system, the engine must be started and stopped by hand when the heat of a furnace or the cold of a refrigerator or home freezer reaches the proper level or the water tank is full. *Don't go away and leave the engine running.*

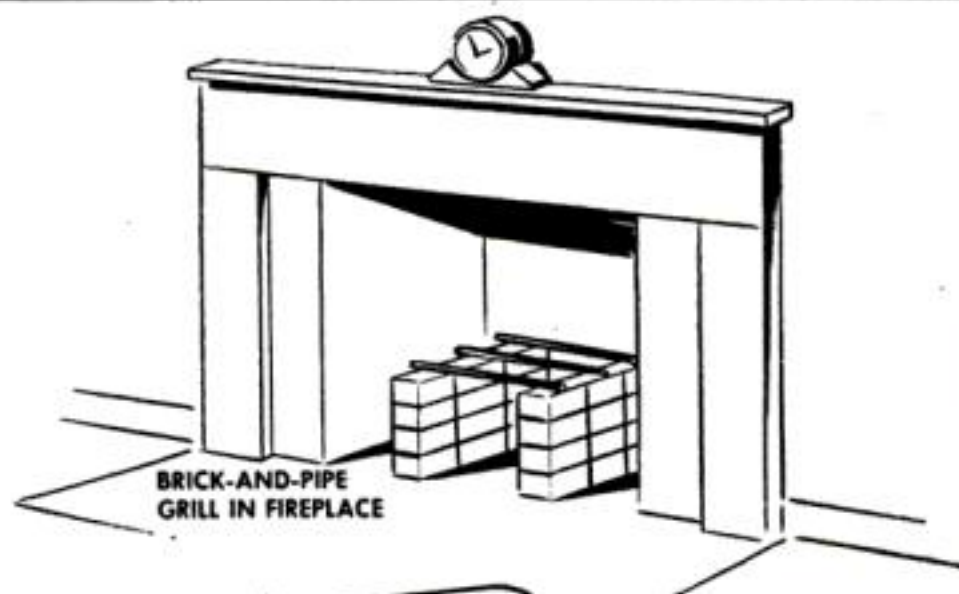
Don't Heat the Whole House

Even if it is impossible to contrive some way to make your furnace run without electricity, there are other ways of keeping your family warm.

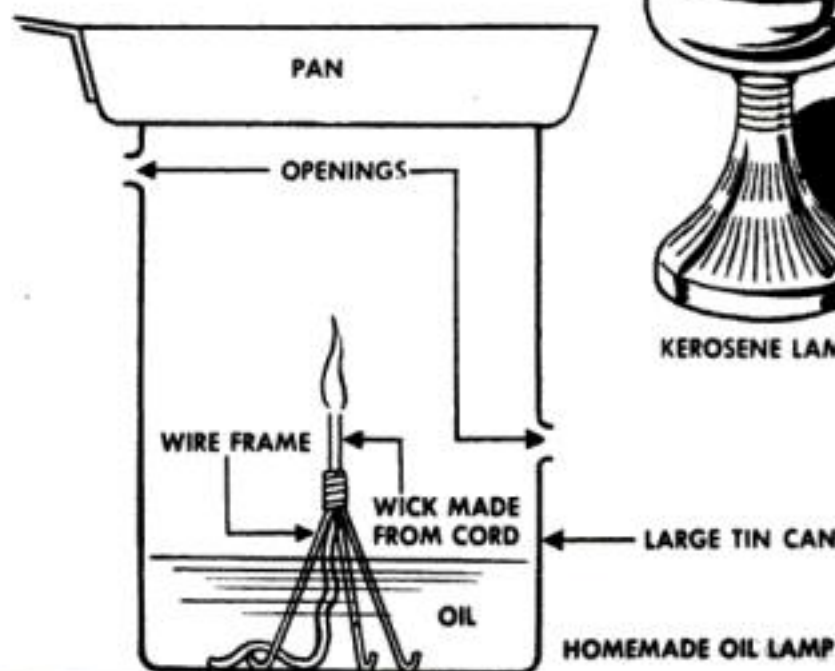
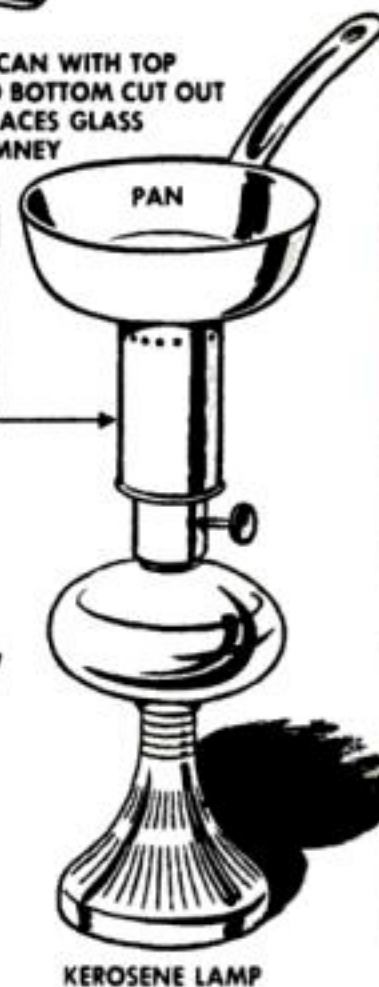
First of all, don't try to heat the whole house by improvised methods. Limit your living quarters to two or three rooms, preferably the living room (especially if it has a fireplace), the kitchen (because it has a stove), and the dining room (because it probably connects the two). Close off the rest of the house. If there are no doors, seal the archways and stair well with blankets held in place with masking tape.

If you have a gas or oil stove in the kitchen, you can keep your emergency living quarters fairly comfortable by running the oven full blast with the oven doors open. It's risky to keep a gas oven on all night. A

FOR EMERGENCY COOKING



TIN CAN WITH TOP AND BOTTOM CUT OUT REPLACES GLASS CHIMNEY



banked wood fire in the fireplace, however, will keep the living room—which can be the sleeping room—warm most of the night. If you haven't a gas or wood range, keep the fireplace going day and night. You can use it for cooking as well as heating.

All sorts of temporary substitutes for a cook stove can be contrived, ranging from a gasoline stove through jellied alcohol to a candle or a kerosene lamp. You'll be surprised at how much heat for cooking is thrown up from a kerosene lamp. Just replace the glass chimney with a soup can from which the top and bottom have been cut. Small holes punched around the upper rim of the can will provide enough draft.

Even the man with a unit-type oil burner, an electric stove, and no fireplace can keep his family warm during a winter power failure. He can limit his living quarters to one room and get his heat for warmth and cooking from a kerosene or gasoline stove. Any ex-GI who ever made friends with a Coleman® stove knows how much heat they can give off in spite of their small size.

A good stock of candles, a couple of kerosene lamps, and a can of kerosene will take care of the lighting problem. And there need be no cleaning up candle drippings after the power is back on if you've had the foresight to keep some old-fashioned saucerlike candle holders on hand.

Unless you have your own well, you probably will have no trouble getting water. If the power fails while the temperature is below freezing, however, be sure to drain water and heating pipes in the part of the house that is not being used. Toilets can still be flushed with a pailful of water. If

there is danger of freezing, add a little kerosene or anti-freeze to the water in toilet bowls and tanks.

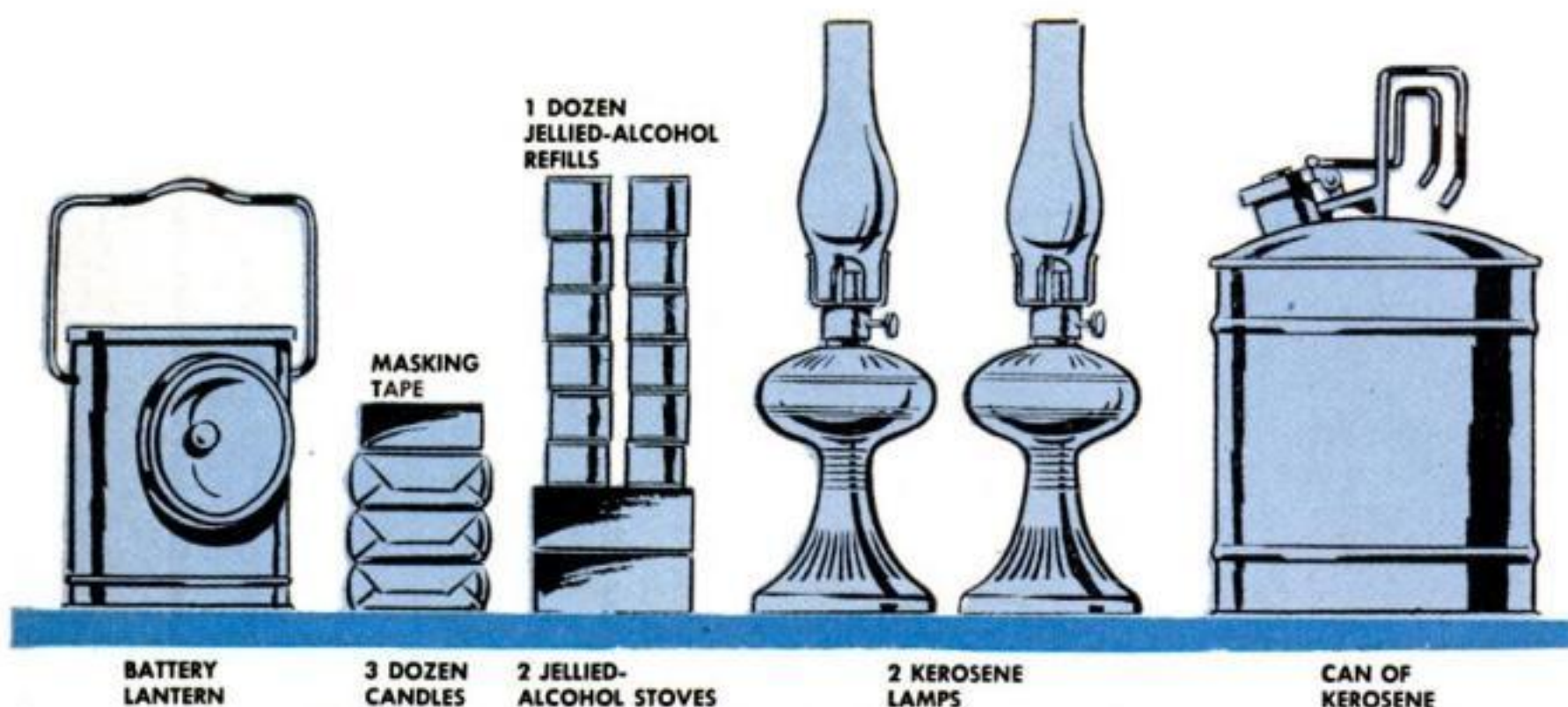
If you have a well but can't operate it, and must carry water from some stream or lake, boil it and then add water-purifying tablets. (During the war, the Army used Halazone® tablets.) If you have no purifying tablets, iodine can be used in an emergency: boil the water, add three drops of iodine to every quart, stir, and allow it to stand for at least 30 minutes before drinking.

The important thing about keeping your home going in an emergency is to be ready. Work out a plan for "damage control" for the entire house. Lay in an emergency stock of candles and holders, cans of jellied alcohol, kerosene lamps, kerosene, masking tape, and a battery lantern. The whole order won't cost you more than \$15, and for less than \$10 more you can add a small gasoline stove.

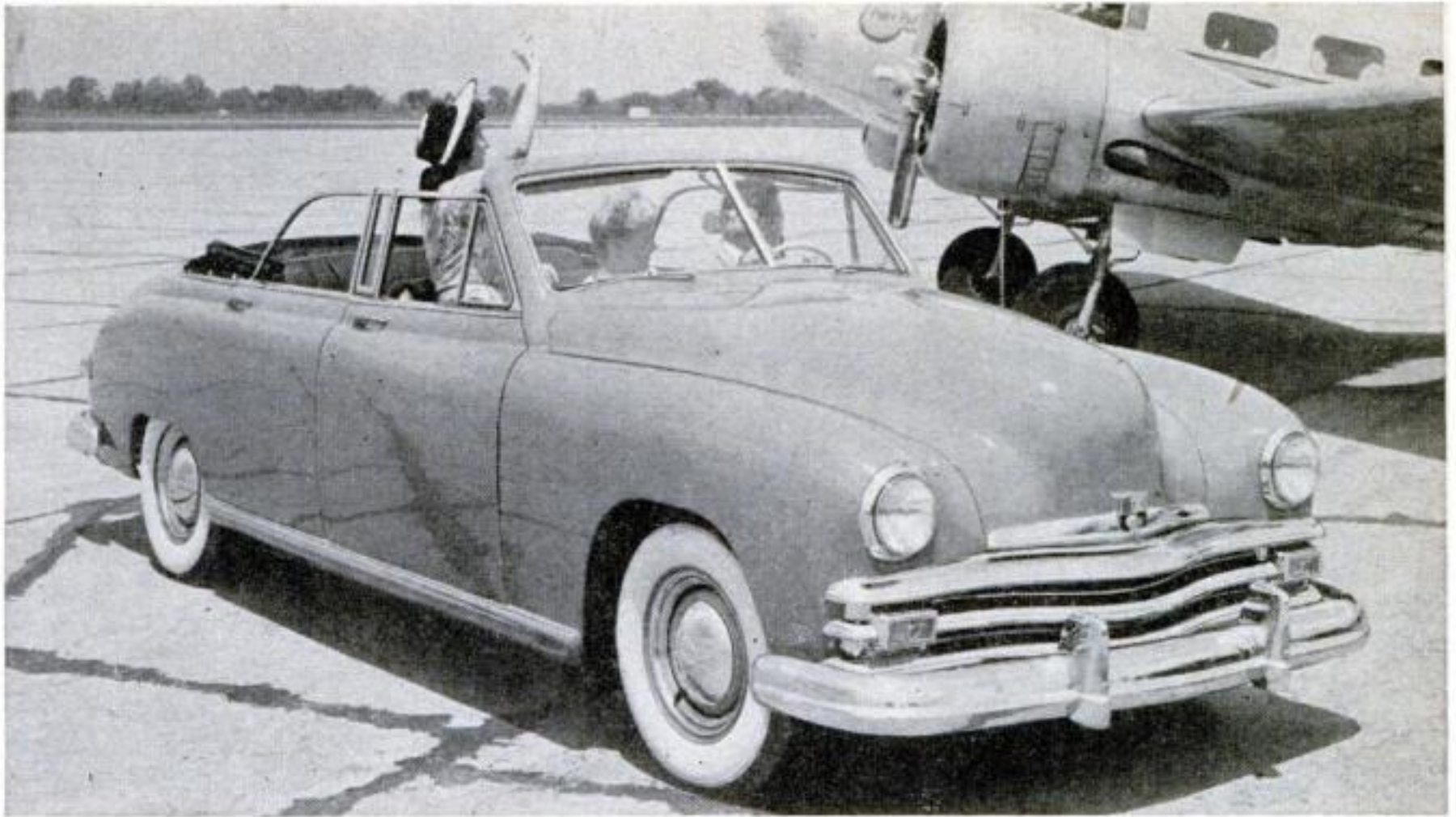
You can even help to prevent power failures. Fully 50 percent of all power failures caused by ice storms could be avoided if homeowners kept their trees trimmed back from the power lines. Inspect the lines that supply your house. If branches hang perilously close to the wires, cut them off. Most power companies will gladly do the job for nothing if you ask them.

Above all, be sure that the power has really failed. I know one suburbanite who moved his family to the city when his own and his neighbors' lights went out last winter. Five days later, he found that the power had never really been off at his house. The only trouble was that his main fuse had blown.

END



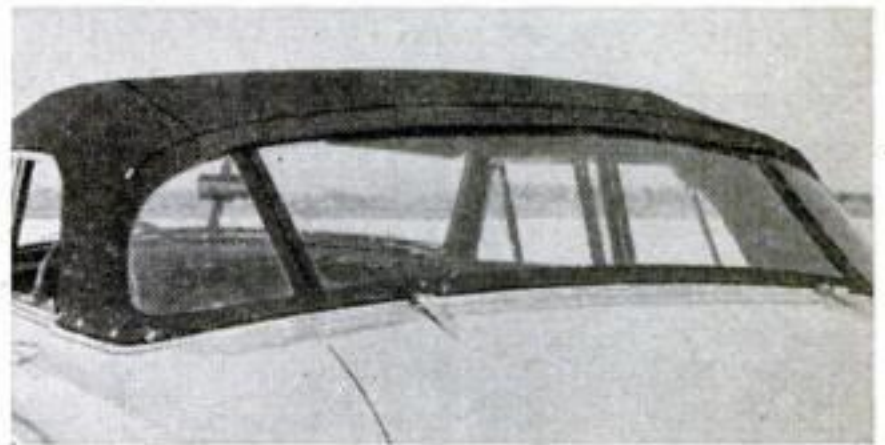
An emergency shelf like the one above costs only \$15 but may be worth its weight in gold.



Four-Door Convertible Has All-Plastic Top

THE first four-door convertible to roll off the production line since the war is this Kaiser with an all-plastic top. The covering is a nylon fabric, available in a variety of colors to match the upholstery. Gone is the customary rear-view slit. Instead, the entire rear window is made in three sections of clear, flexible plastic, as shown at right, providing full, unobstructed vision in the back and at the sides. The center section folds down to give better ventilation when bad weather keeps the top up.

The top and all four side windows are hydraulically operated by push-button controls. The narrow frame of glass separating

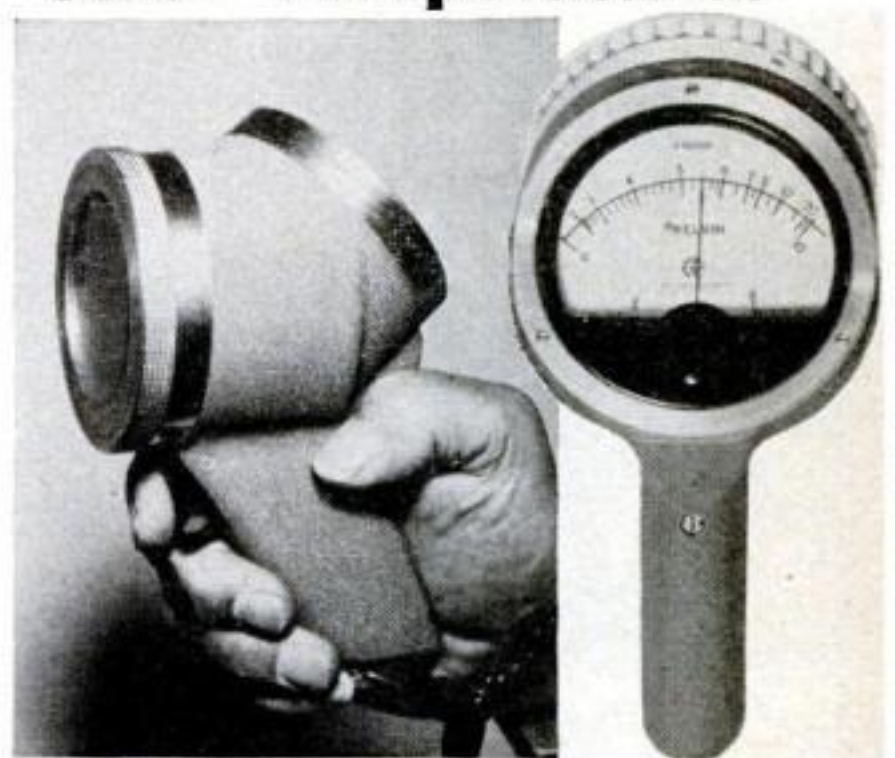


the front and rear side windows, which remains in place at all times, provides a tight fit between the two windows to keep out winter drafts.

The car's chassis and body dimensions are the same as the four-door, hard-top 1949 Kaiser Deluxe, and the rear-seat leg room and the 112-hp. engine are also identical.

Camera Meter Measures Color Temperatures

IF THE color balance of your subject's light doesn't match the balance of your color film, this Spectra[®] color-temperature meter will tell you at a glance exactly how much correction is necessary. Just point it at the light source, squeeze the trigger on its pistol grip, and a needle instantly registers the color temperature of the light to within 100 degrees Kelvin. If correction is indicated, it can then be made with color-compensating filters. The photoelectric device has a range from candle light to the brightest sky. The angled dial lets the user point the meter at the sky and still read the dial without looking up himself.





Microscope Is Simplified

MACHINE-TURNED fittings and a simplified focusing mechanism cut the cost of this new microscope for high-school science students. Its fine adjustment, for example, has only 10 parts, as compared with 50 in a standard laboratory instrument. Made by Bausch & Lomb to sell for less than \$100, it magnifies to 100 and 500 diameters.



Snow Scooter Has Brake

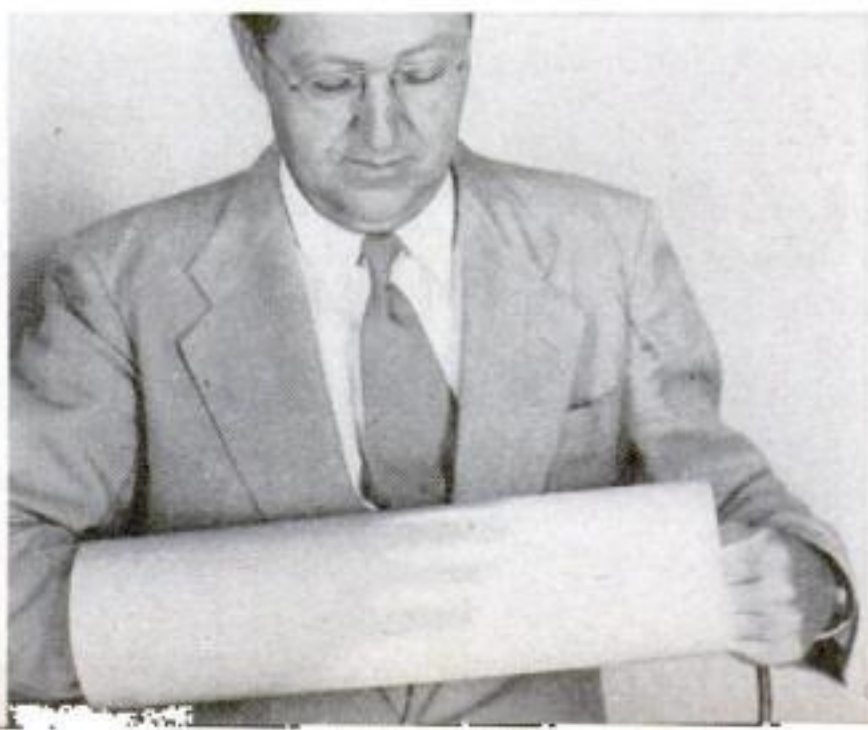
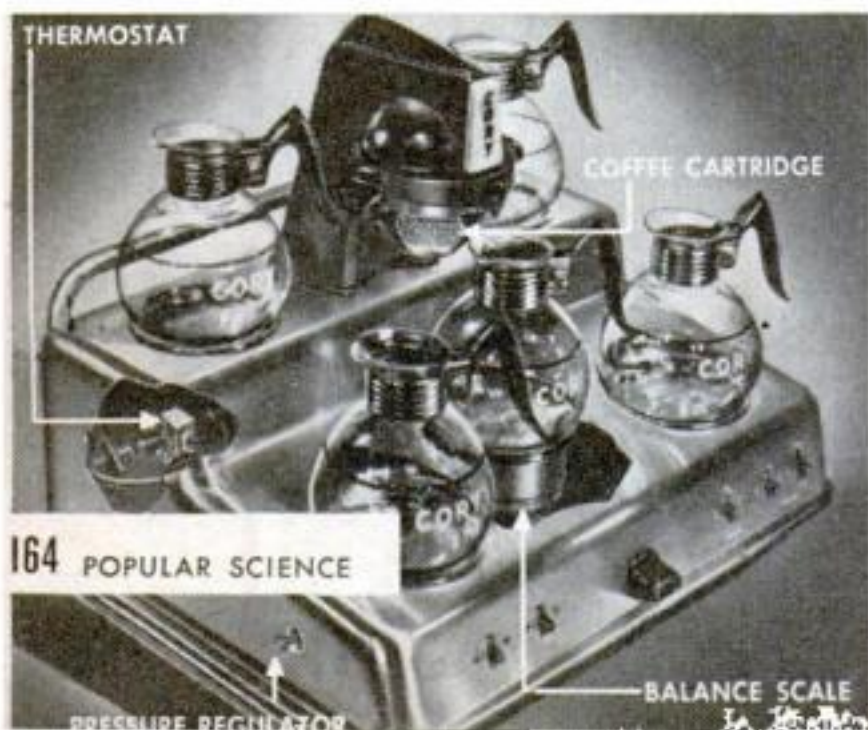
You can skim down a snowy hill on this new Sked[®] without long practice in keeping your balance—and with less danger of hitting a tree. When an obstacle looms, just rock back on both footrests to press drag brakes, projecting from both heel guards, into the snow. To steer, apply one brake. For towing, the handlebars flop forward.

Brewer Controls Coffee

MAKING coffee of uniform strength depends on controlling the amount of coffee used, the amount of water, water temperature, and how long the water is in contact with the coffee. All four factors are regulated automatically by the new Cory coffee brewer below. A thermostat controls the temperature of the water, and a pressure regulator times its flow through the coffee in a cartridge. A balance scale under the spout shuts off the water when just enough has dripped into the pot.

Army Tests Glass Pipe

LIGHT shines right through this Fiberglass[®] pipe, as you can see in the photo below. Yet it's so strong that the Army is testing it for pipelines to carry gasoline and oil. The new pipe is not only tough and noncorrosive, but so light that a 20-ft. section of the size shown here— $\frac{3}{8}$ in. thick, 8 in. across—weighs only 40 lb., as compared with 185 lb. for a similar section of steel pipe. An added advantage is that its principal raw material—sand—is not a critical commodity in wartime.





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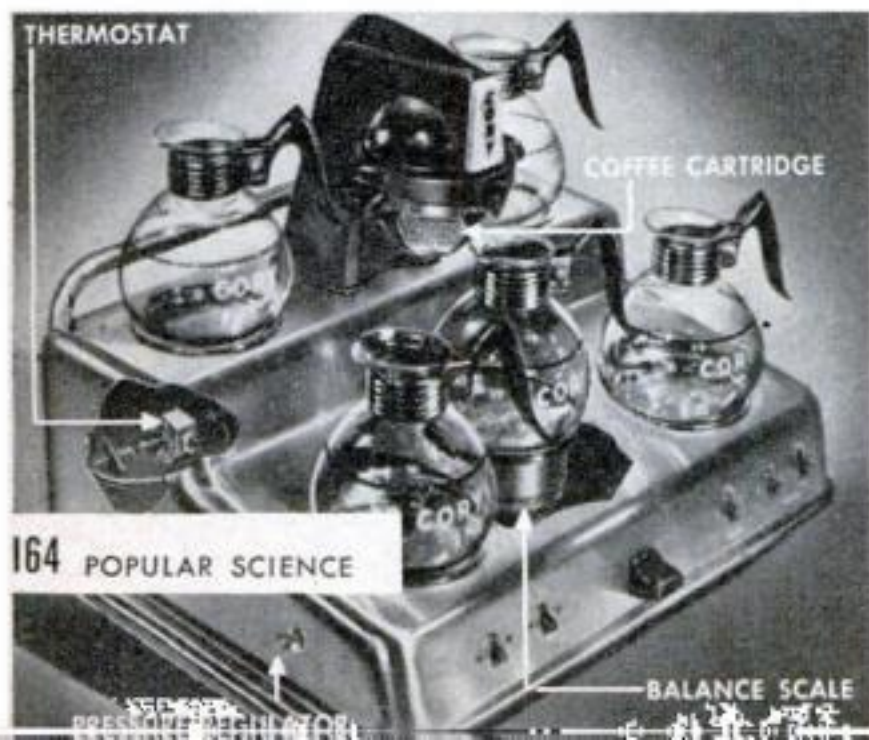
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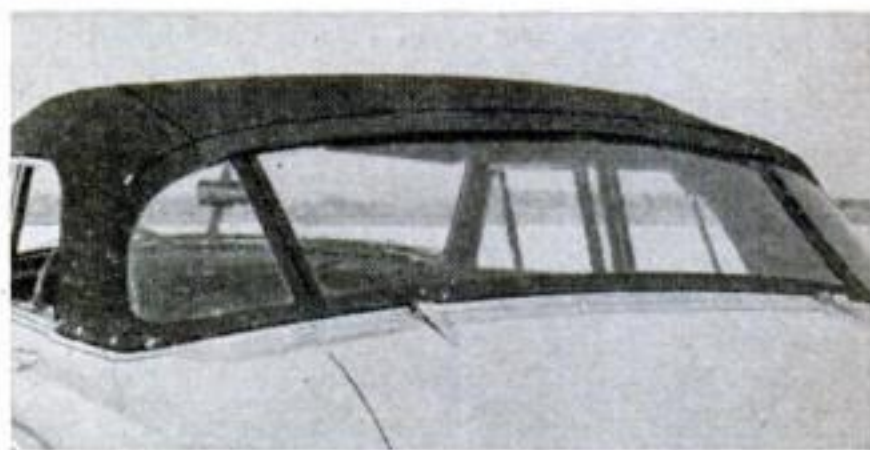




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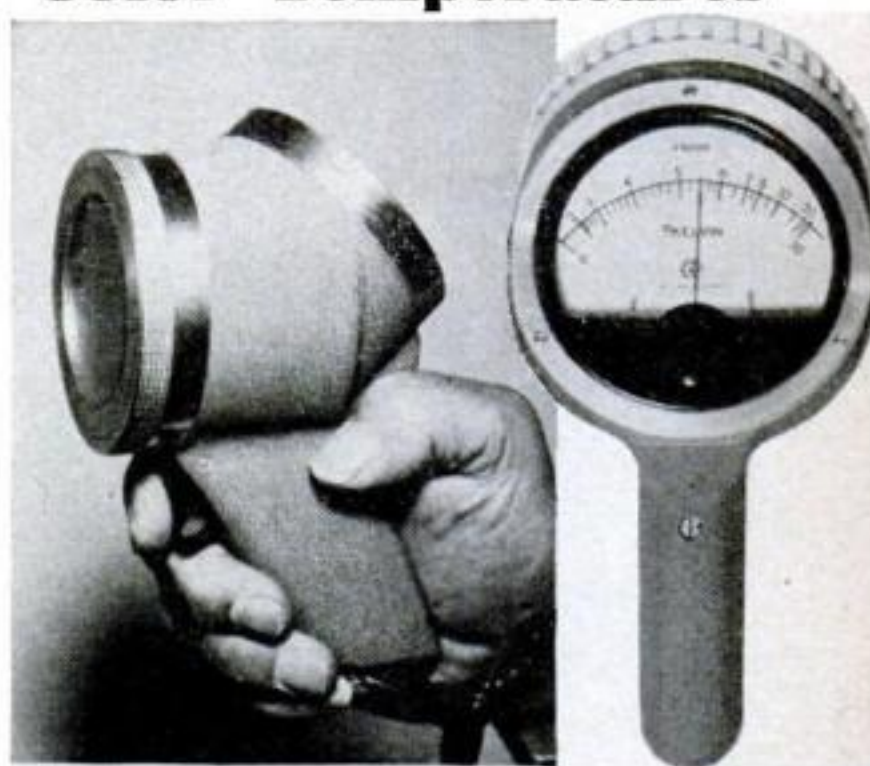


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at last getting a hand from modern science.

Electrical vibration meters now spot flaws in tone that human ears might miss. And recently, with GE, the Meneely company has perfected the first major advance in bell design since the Middle Ages.

This is an electrical ringing system by which sets of tuned bells can be played

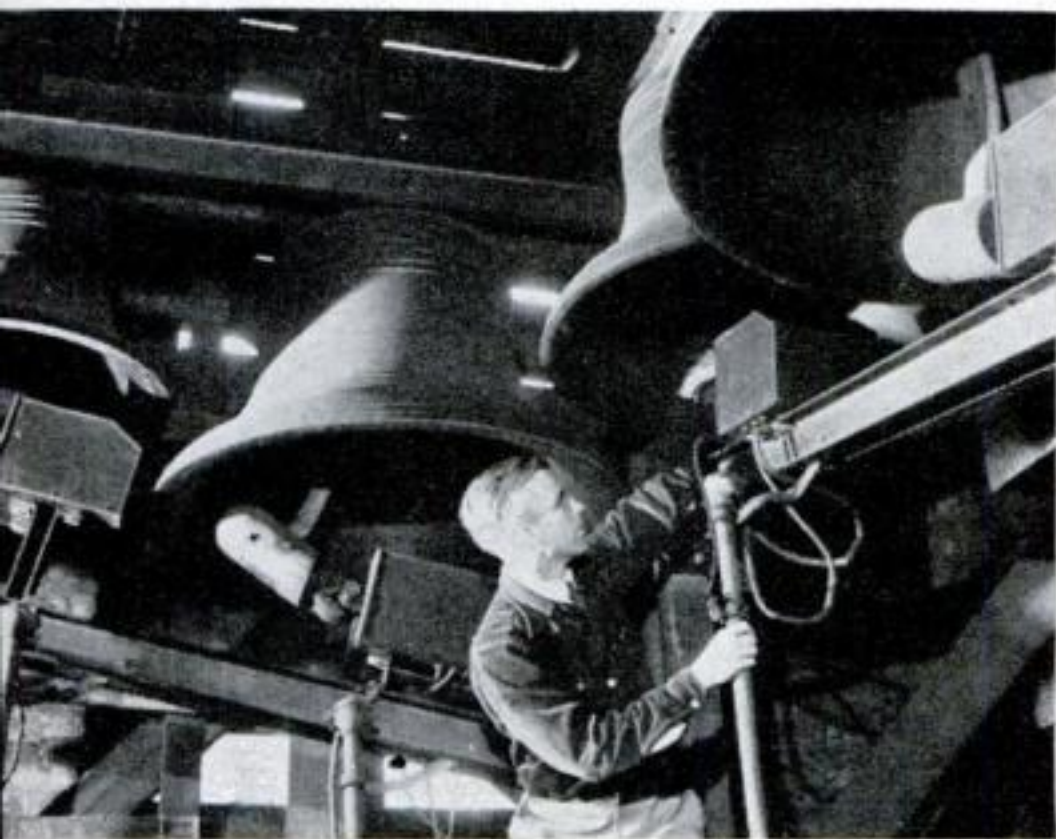
from a remote console that looks like the keyboard of a small organ. The keys actuate electromagnets that swing specially designed clappers inside the stationary bells, fixed on their mounts so they do not swing. A refinement of this system even plays tunes automatically from perforated rolls like those used in a player piano.



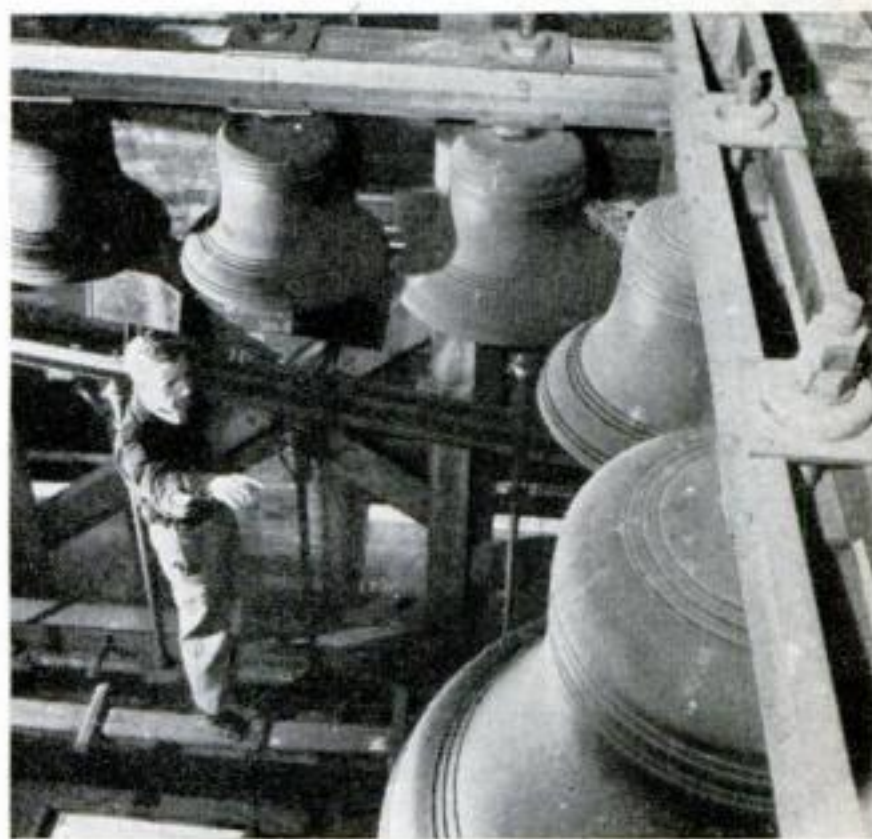
Bell metal, poured between inner and outer molds, is tin-copper alloy. In melting, it's stirred with green saplings: steam from sap speeds mixing, and charcoal helps to burn off impurities.



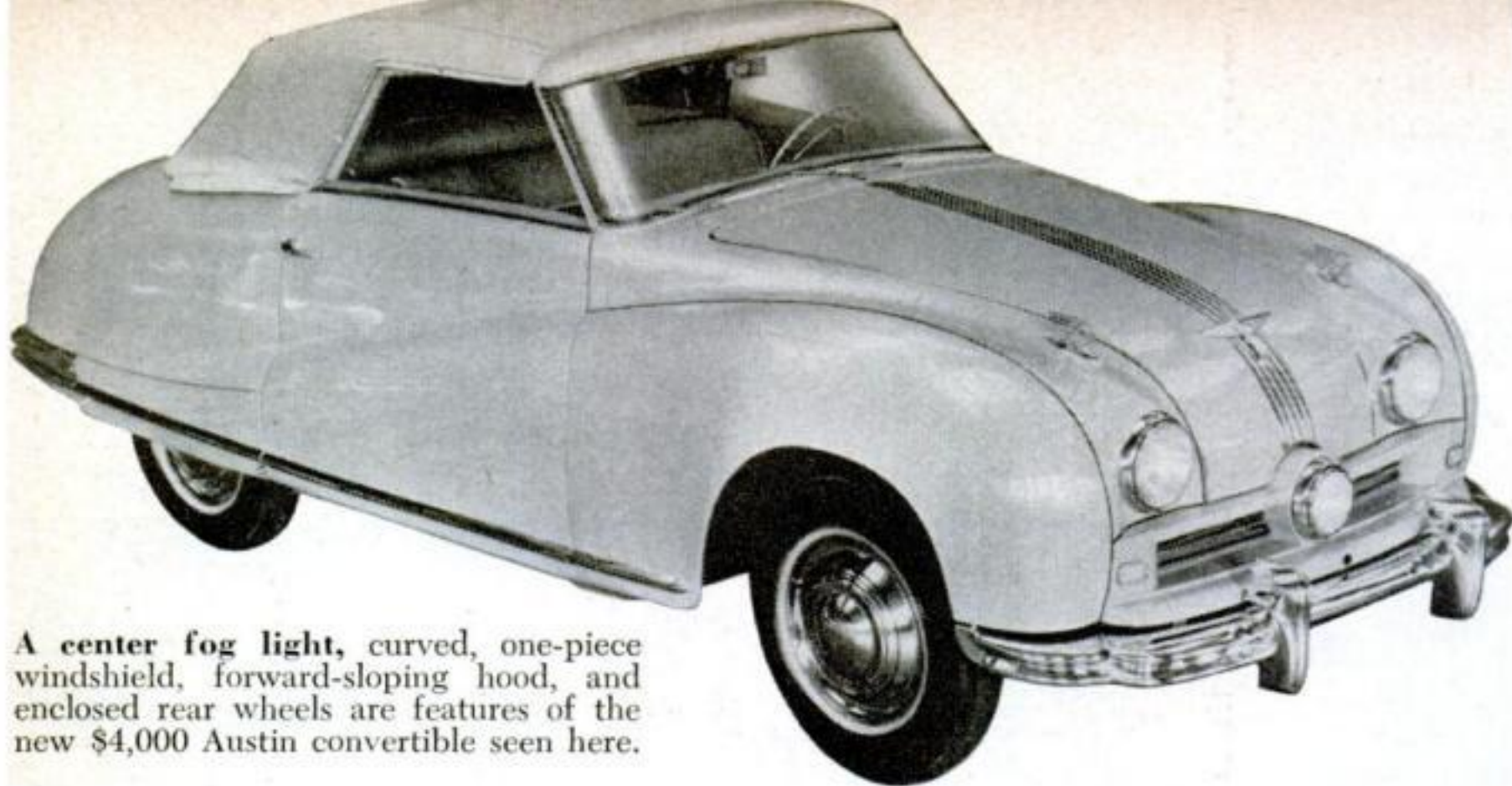
After slow hardening of casting while buried to retard cooling, outer mold is lifted off and bell is hoisted from pit. Inner mold is knocked loose and the crust of burned clay scraped off.



Electric hammers, swung by strong magnets, hit bells at touch of keys on remote console. Since these hammers can strike rapid repeat blows, they make it possible to play faster tunes.



Mounting bells is a problem in acoustics and electrical and mechanical engineering. This console set in St. Agnes Church at Cohoes, N. Y., contains 15 bells ranging from 150 to 3,000 lb.



A center fog light, curved, one-piece windshield, forward-sloping hood, and enclosed rear wheels are features of the new \$4,000 Austin convertible seen here.

Newest Austin Is No Baby

THE new Austin convertible costs \$4,000.

What do you get for your money? For one thing, a higher compression ratio than in any present American stock car. For another, a battery that should outlast the car.

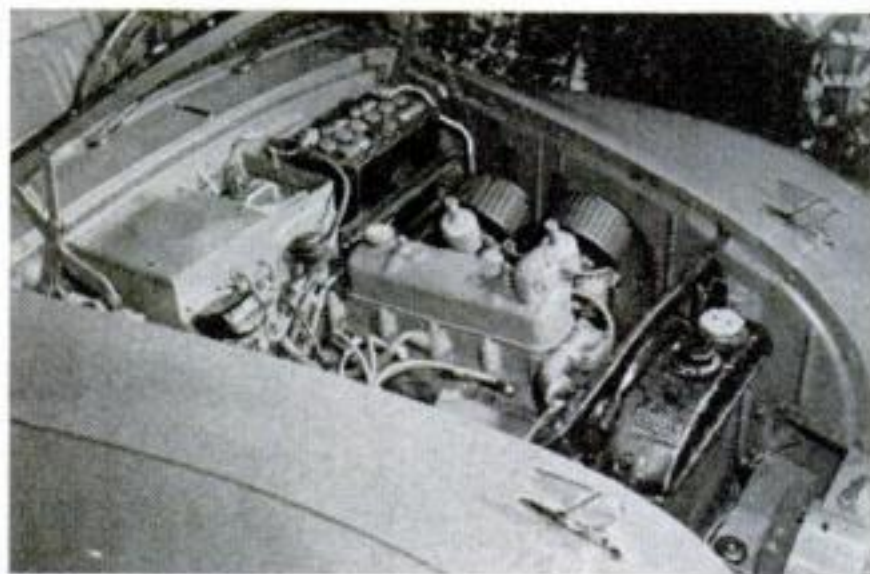
Sleekly streamlined, this new English import boasts a 90-hp., four-cylinder, overhead-valve engine with a 7.5-to-1 compression ratio. Essentially, the engine is a re-bore of the one found in the conventional small Austin, the bore being enlarged to 3.44 inches and the stroke to 4.375 inches. Twin carburetors are used.

Introducing the new model in the United States, the English manufacturer says it is planned to include a nickel-cadmium battery (PS, Aug. '48, p. 112) as standard equipment. Heretofore, this has never been provided in a stock car sold here.

The over-all length (14 ft. 9 in.) of the five-passenger convertible is 24 inches more than the ordinary small Austin. The wheel-base measures 96 inches, an increase of about 4 inches. The top and windows are hydraulically operated.

A metal "forehead" across the top of the curved, one-piece windshield increases its strength and gives the car a distinctive appearance. Instrument controls are centrally located on the dash. The steering wheel is adjustable to your reach. To baffle gas thieves, the gasoline filler pipe is inside the rear luggage compartment.

The car has a top speed of about 90 m.p.h., and it makes a little more than 20 miles to the gallon.



Twin carburetors feed the 90-hp. engine. In above photo, you can see these and their air cleaners on far side of engine. Carburetors are synchronized, each feeding two cylinders.

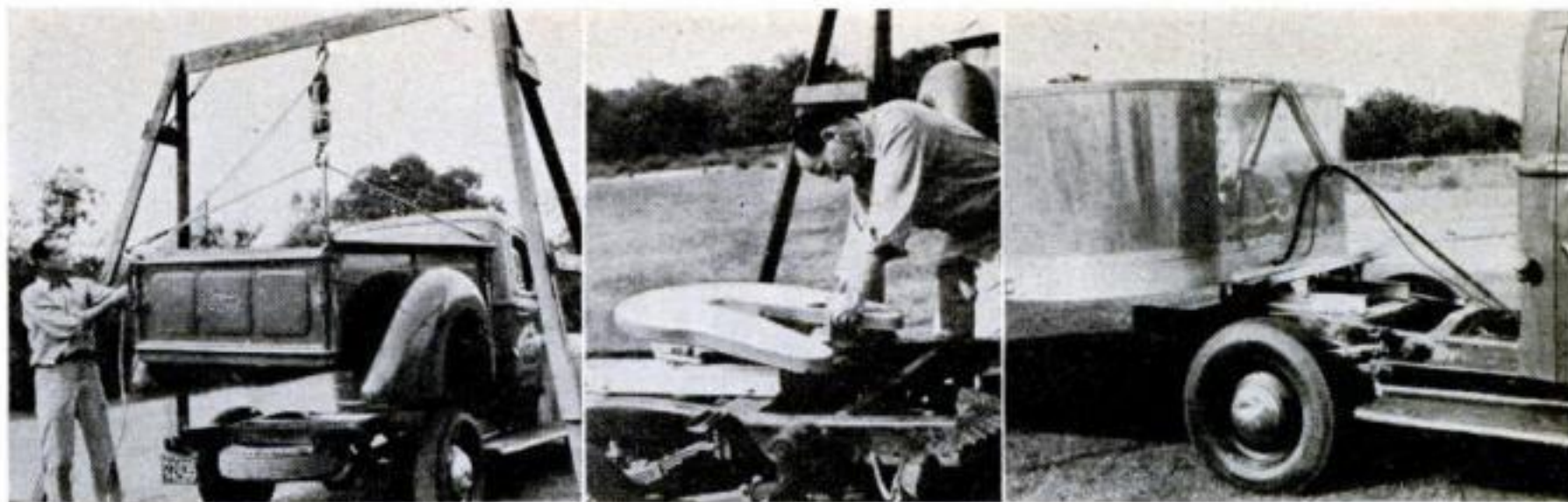


Removing the rear seat enlarges the luggage compartment, which is completely carpeted. Both the cushion and back rest come out. The sport car has leather upholstery throughout.

Three push buttons on the driver's door operate the top and both windows through a hydraulic mechanism. Parcel compartments are located in this door on each side of push-button panel.



6132

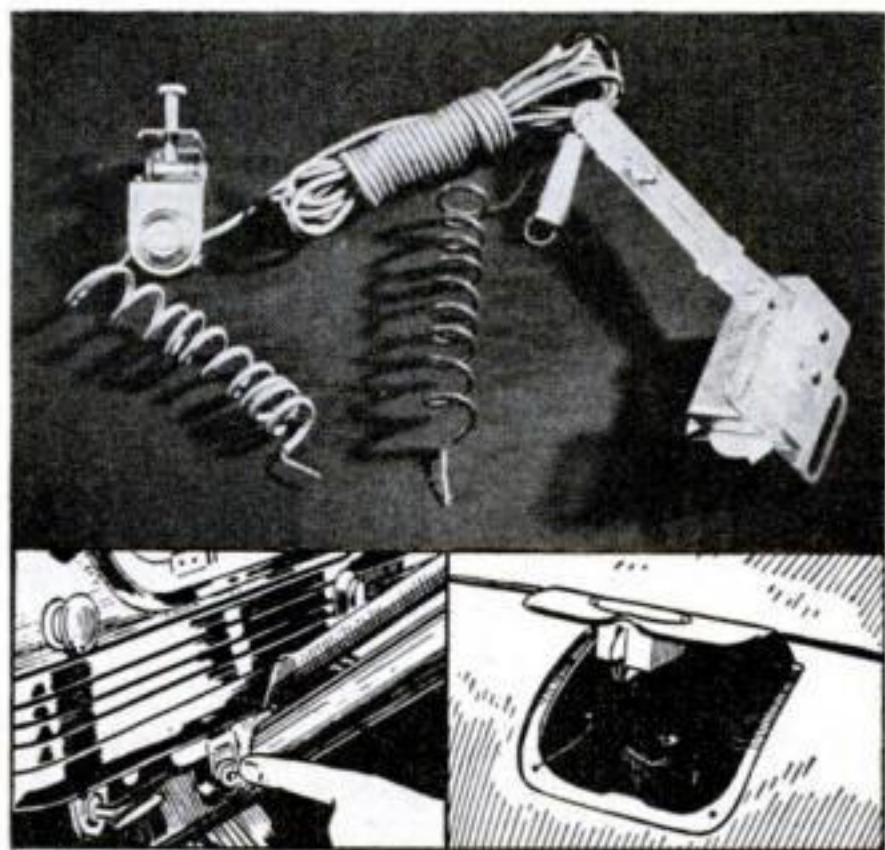


Semi-trailer Quickly Hooks to Pickup or Jeep

JUST as a horse can pull more weight than he can carry, this light semi-trailer greatly boosts the load capacity of a truck or Jeep.

The truck is quickly shifted from pickup to trailer use. After the bed is removed with a block and tackle, a fifth wheel is bolted on and the truck backed under the

trailer. Brake and electric lines are snapped on and you're ready to go. Built largely of aluminum, the trailer provides 600 cu. ft. of van space, has vacuum-boosted hydraulic brakes, and handles payloads of 6,000 to 10,000 lbs. It's made by Texas Sheet Metal & Mfg. Co., Dallas, Texas.



Dash Button Unlocks Gas Tank

IF THE filler pipe of your gas tank is concealed by a fender door, here's a way of preventing fuel theft. Called Fen-Dor-Lok®, the accessory enables you to open the door by pushing a button mounted on the instrument panel. The door locks automatically when it's closed.

Mounted under the door, the body of the accessory contains an electromagnet that actuates a locking cam. When this cam is withdrawn from its catch, a spring snaps up the fender door. The control button is wired to the dead side of the ignition switch. Steel Manufacturing Co., Ashland, Ky., makes the lock for about \$6.

6254



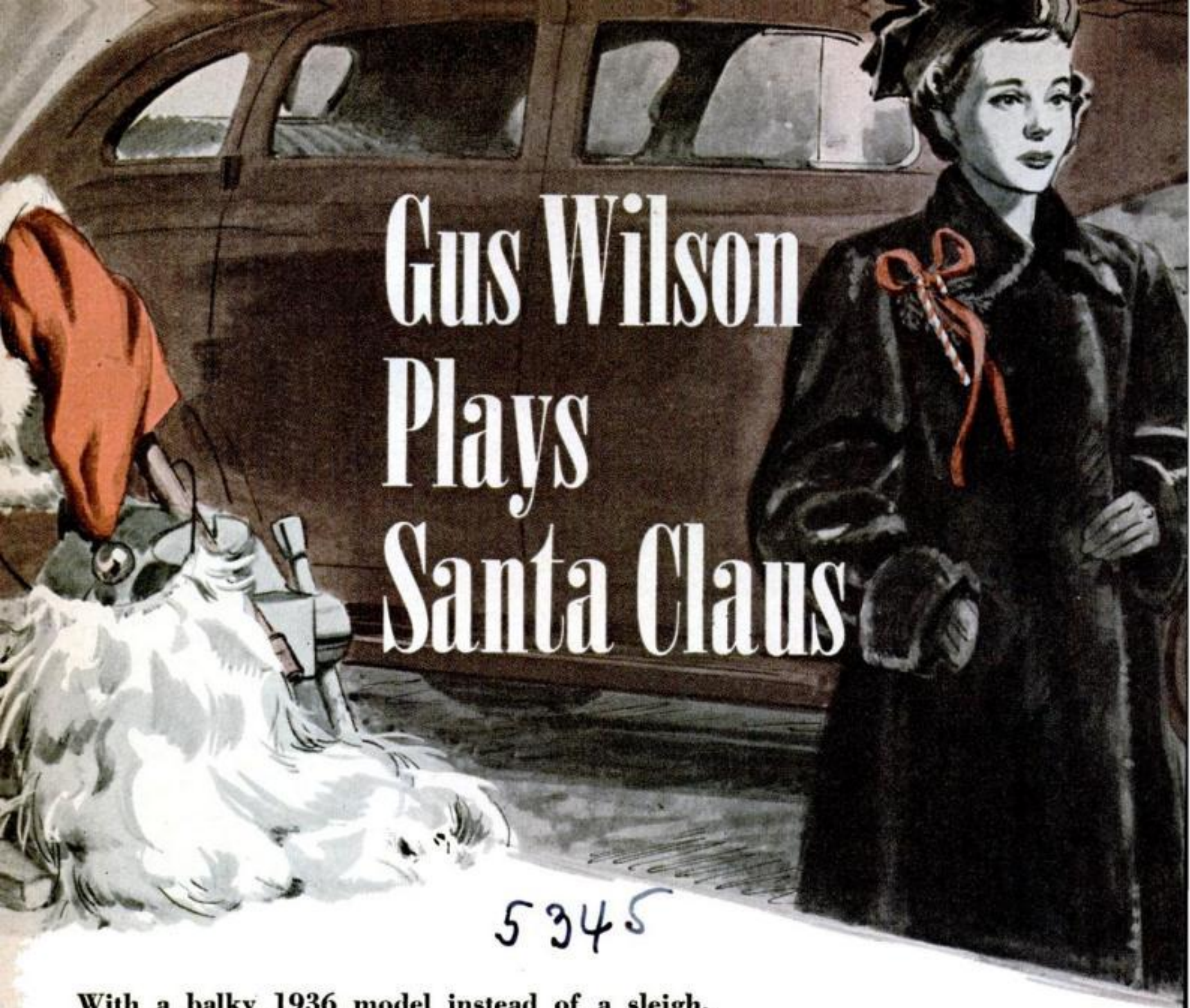
Harley Introduces New Fork

HERE'S a cutaway of the hydraulic fork that you'll find on two of the 1949 Harley-Davidsons, the 61- and 74-cu. in. overhead-valve models. Synthetic oil of high viscosity dampens the action of the long helical springs. The fork has a total stroke of 5¼".

Other changes in these models include a larger front brake, Timken upper and lower steering-head bearings, and cylinders treated to resist corrosion. Rubber-mounted handle bars are available for all models to increase riding comfort if desired.

6344

DECEMBER 1948 169



Gus Wilson Plays Santa Claus

5345

With a balky 1936 model instead of a sleigh, Gus plays Santa in two different places at once.

By Martin Bunn

A FEW minutes earlier the hands of the Model Garage clock had pointed to quitting time. Wrapped in heavy coats and mufflers, Stan Hicks and Greg Jones, the grease monkey, were leaving. Gus Wilson was still at his bench, working over a carburetor.

"Merry Christmas, boss," Stan waved. "Don't eat too much turkey."

"Same to you," Gus grinned. "Have a good time."

A splatter of fine rain swirled through the door as Stan and Greg stepped out into the storm. Gus turned back to his job. He still had more than two hours before the Police Department's annual party for kids. Gus was to play Santa Claus this year.

At six o'clock he put away his tools, wriggled out of his coveralls, and washed

up. Then he unwrapped the well-padded Santa Claus outfit and put it on. Grinning widely, he studied himself in the mirror over the wash basin. He held the false whiskers up to his face for a minute and again looked in the mirror.

"Just try 'em on for size," he murmured. Gus put the whiskers aside and stepped to the front window for a look at the weather. The temperature had dropped a few degrees and the rain had changed to snow—big, wet flakes that were beginning to whiten the highway. Across the road, the lights of the diner gleamed dimly. Occasionally, the lights of a slow-moving car showed up through the gloom. By morning, Gus thought, there'll be a lot of drivers wondering why they didn't get their chains fixed before they put 'em away last spring.

As he turned from the window, headlights flared and a horn sounded. Someone



had turned into the garage driveway. Gus hesitated, wondering why he hadn't thought to turn out the shop lights. He glanced at the clock, saw he had time to spare, and rolled the shop door aside.

A 1936 sedan, showing its years only too well, rolled slowly into the shop. Gus shoved the door shut and turned to see a young woman smiling at him.

"I'd just about stopped believing in you,"

she said, "but I'm certainly glad to see you right now."

Gus stared at her for a moment, and then remembered his costume and grinned. "Oh, this get-up," he said, looking down at his overstuffed red suit, "I'm Santa Claus at a kids' party this evening. Guess I got dressed up for the occasion a little ahead of time."

"Well, I hope you have a gift for me, or

for my car, at least. It could do with one."

"What's the trouble with it?" Gus asked.

"I don't know," she said. "It just doesn't want to run. And it's got to run. I've got to get to a kids' party too, and it's a hundred and fifty miles from here."

Gus started to say that it wasn't a night for anyone to be driving that far, much less a girl, but then something in her eyes told him it would take more than a snowstorm to stop her.

"I suppose the car's just getting old," she went on. "It's a '36 model. My husband drove it sixty thousand miles before the Army sent him overseas. Then after—after the war I had the motor rebuilt, and I've driven it over thirty thousand since then. I travel for a cosmetics company and my job keeps me moving around a lot."

"How does it act?" Gus asked.

"The motor misses and stalls almost every time I stop," she answered. "It must have been about two months ago, when I was in Chicago, that it started. I noticed too that it was using up an awful lot of gasoline. The man at a garage there told me that gasoline was running down into the crankcase and diluting the oil."

"What'd he do about it?"

"Put a new fuel pump on. Not a rebuilt one. I asked about that, but he said it had to be a new one. And it didn't do a bit of good. I didn't get more than six or seven miles to the gallon when I drove to Detroit."

"Somebody in Detroit should have known what was wrong," Gus smiled.

"That's what I thought, too," she said. "I thought people there would know all about cars. But they didn't. At least not at the garage I went to. They put on an electric fuel pump. The man said that would stop the trouble because an electric fuel pump doesn't connect with the crankcase."

"Apparently that didn't do the trick."

"No, it didn't. It was just as bad as ever. Then I drove to Cleveland. Two big places hadn't helped, so this time I tried a little shop on a side street. The mechanic went all over the motor and said the valves were causing the trouble. He ground the valves and put in new valve guides. After he finished the job, he tested the compression—whatever that is—and told me it was okay and that I wouldn't have any more trouble."

"But you have," Gus said.

"I certainly have. The car still uses too much gas, it keeps missing, and gas still gets into the oil. The trip from Cleveland

was a nightmare. I stalled at a traffic light down the road and a motorcycle cop told me to try your place. He said he had just been by here and noticed your lights still burning, so he knew you hadn't closed."

Gus looked at the clock again and then back at the girl. There were tears in her eyes. She looked down and began fumbling in her handbag for a handkerchief.

"Make yourself comfortable over there by the radiator," Gus told her. "I'll see what we can do about getting you rolling on your way home again."

"Thank you." She opened her coat and pulled a chair up to the radiator. But in a moment she was up again. "Try to do something quick," she urged. "My two kids are at my parents' home—that's standard procedure with war widows, you know—and I've just got to get there in time to have their presents under the tree in the morning." She pointed to a pile of packages in the rear seat.

"Take it easy," Gus smiled, "we'll get you there in time."

The girl smiled and dabbed at her eyes.

After several attempts, Gus started the balky engine. He wasn't so sure about getting her home in time. The engine ran roughly and stalled as soon as he released the throttle. He switched off the ignition, got out of the car, and pulled out the oil stick. It showed the crankcase oil was over an inch above normal level. He rolled a drop of it between thumb and finger and found it much too thin. He sniffed it and found a smell of gasoline.

"How long since you had the oil changed?" he asked.

"Only yesterday," she answered.

Gus turned back to the engine and thought for a minute. "Where have you been keeping your car during this cold weather—in a garage or outdoors?"

"In parking lots," she said. "They're much less expensive than garages."

Her frankness about expenses turned his thoughts to the two kids a hundred and fifty miles away. He unclamped the upper radiator hose and saw there was no thermostat in the cylinder-head water outlet.

"This explains some of the trouble," he told her. "No thermostat. That's why you're using so much gasoline and why a lot of it is getting into the crankcase."

"Why?" she asked.

Gus grinned. "When some cars are parked outdoors in cold weather, as much as

a gallon of gas is used while the engine is warming up. Some of the gas is burned, of course, but some of it seeps into the crankcase. I can fix that in a hurry by putting in a high-limit thermostat and also a shield in front of the lower half of the radiator. Together, they'll cause the engine to heat up quicker. You won't have to choke it so much and less gasoline will get into the crankcase. What does will evaporate faster. Get it?"

"No," she said, "I don't. But if that will fix it, go ahead and do it."

"One other thing," Gus said, "what kind of antifreeze do you have in the radiator—permanent or alcohol antifreeze?"

"It's the permanent kind," she answered quickly. "I know. I watched the man put it in the radiator and it said on the can that it was permanent. The man told me that if my radiator didn't leak, I wouldn't have to bother with it until Spring."

"That's good," Gus said, "because the radiator shield and the high-limit thermostat won't do with a low-boiling antifreeze in the radiator."

As Gus went about installing the thermostat and fitting the shield, the girl came over to watch. "That's fine, fixing that," she said, "but what about the motor acting the way it does? That's worse than using too much gasoline. Tonight, anyway."

"Yes," he admitted, "we've still got to lick that." He tightened the hose clamps and started the engine. It ran roughly, as though the carburetor was in bad shape.

"See?" she said.

"Could be the idling jet," Gus mused, "or it could—yes, that could be it." He cut the engine, jumped out of the car, and took off the air cleaner.

"What's that?" the girl asked.

"Air cleaner," Gus answered, "and there's the cause of the missing and stalling." He pointed to the filter element that was heavily clogged with dirt. "The filter is so dirty that nowhere near enough air can get through. Much too rich a mixture is being drawn into the cylinders. A lot of it can't burn, so it seeps down into the crankcase and dilutes the oil. This filter, plus the excess choking needed with a cold motor, was wasting plenty gas."

Within ten minutes he had washed the filter in gasoline, re-oiled it, and replaced the air cleaner. When he started the engine this time, it ran smoothly.

"There you are," Gus said, "all ready to

roll. Seems like one of those mechanics who worked on your car would have found that filter. But no matter, now. You won't have any more trouble, and unless you get snowed in you'll have those presents under the tree before the kids come down in the morning. But I'm afraid you're going to have a tough drive."

"I can take it," the girl said. She opened her purse. "How much do I owe you?"

Gus grinned and held open the car door for her. "We'll call that a Christmas present from Santa Claus to the kids," he said.

"All right," she said, "if that's the way you want it." Quickly she slipped her arm around his neck, pulled his head down, and kissed him. "That's a present from the kids to Santa Claus."

She backed the car out of the shop, turned it, and headed out the driveway through the whirling snowflakes. Gus stood in the doorway and watched until the car's taillights were out of sight. Then he closed the shop door and started back to wash up and put on his Santa Claus whiskers. Joe Clark, his partner, was leaning in the doorway from the office to the shop, grinning at him.

"Saw the shop lights and stopped in," Joe explained. "Been working overtime?"

"Just a little emergency job," Gus said.

"Well," Joe laughed, "sometimes those emergency jobs pay off pretty well."

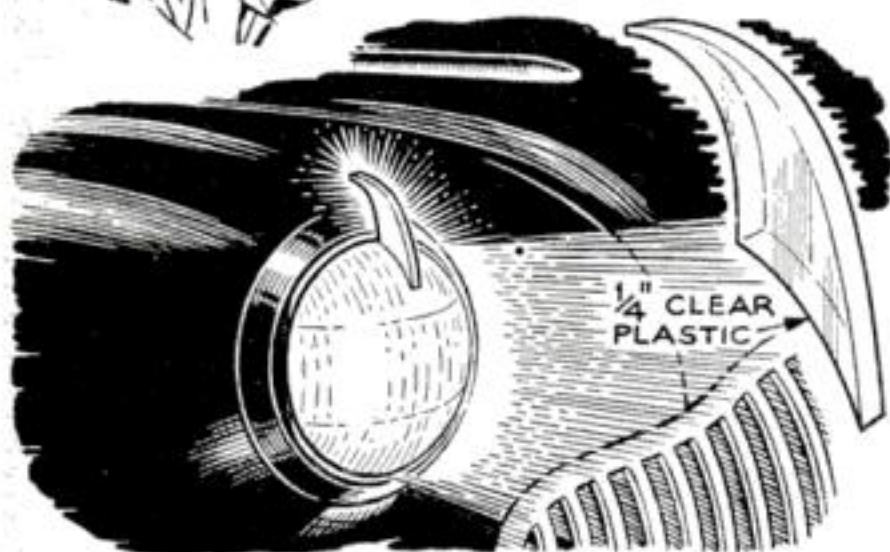
Gus tied his false whiskers in place and turned from the mirror. "That's right," he agreed, "sometimes they do. Going to the kids' party, Joe?"

"I sure am," Joe said. "I'm full of the Christmas spirit—same as you." END



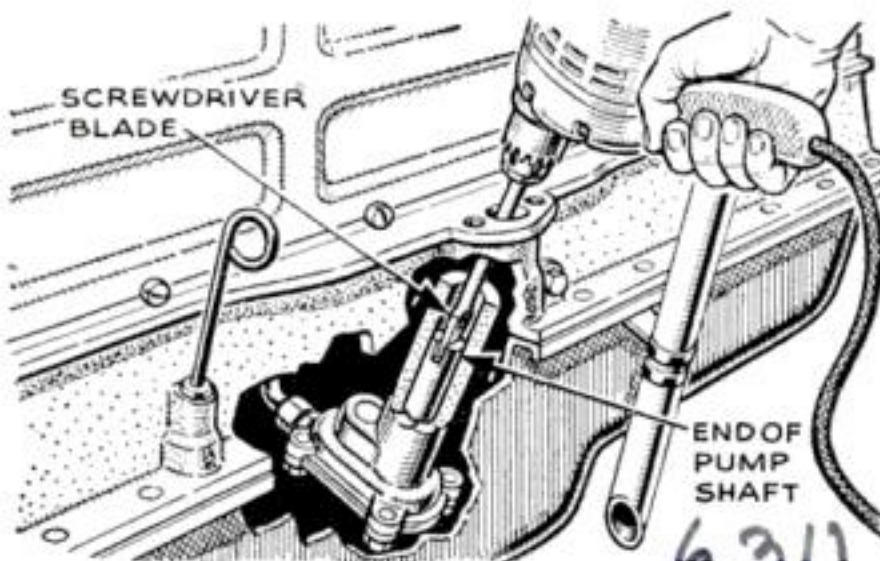


Hints From the Model Garage



Plastic Shows Lights Are On. If a headlight burns out, you'll know it without leaving the car. Edge-lighted along the lower surface, a horn-shaped indicator cut from plastic carries the illumination up where you can see it. A good cement job will hold it on, or a metal strip screwed to rear corner can be clamped by lamp rim.

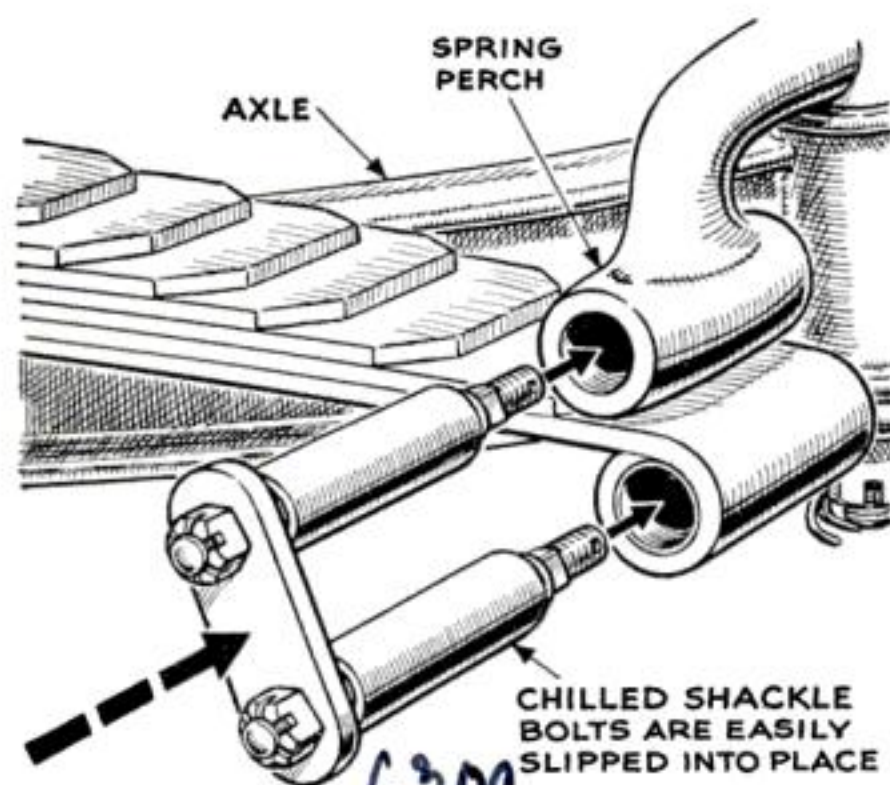
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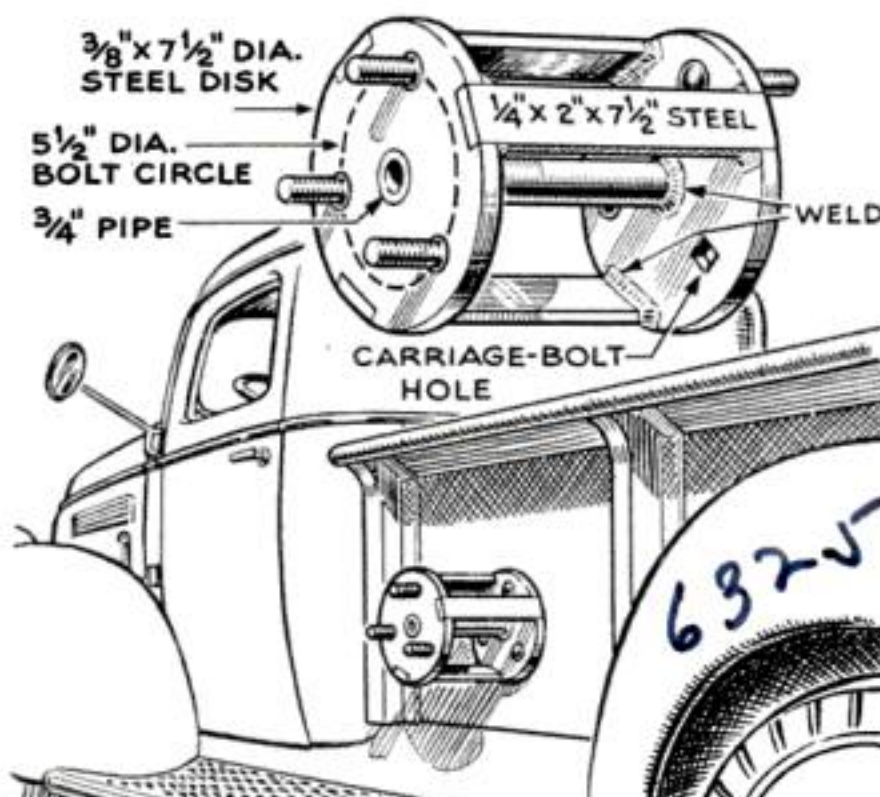
Drill Primes Pump. When an engine is started after an overhaul, oil pressure must come up fast to protect dry, tight wearing surfaces. Reader George Pedley, working on a Chevrolet engine, used an electric drill to run the pump until the oil gauge showed pressure. Then he finished assembly, timed the engine, and started it.

Box 12, No. Grosvenor, Dale,



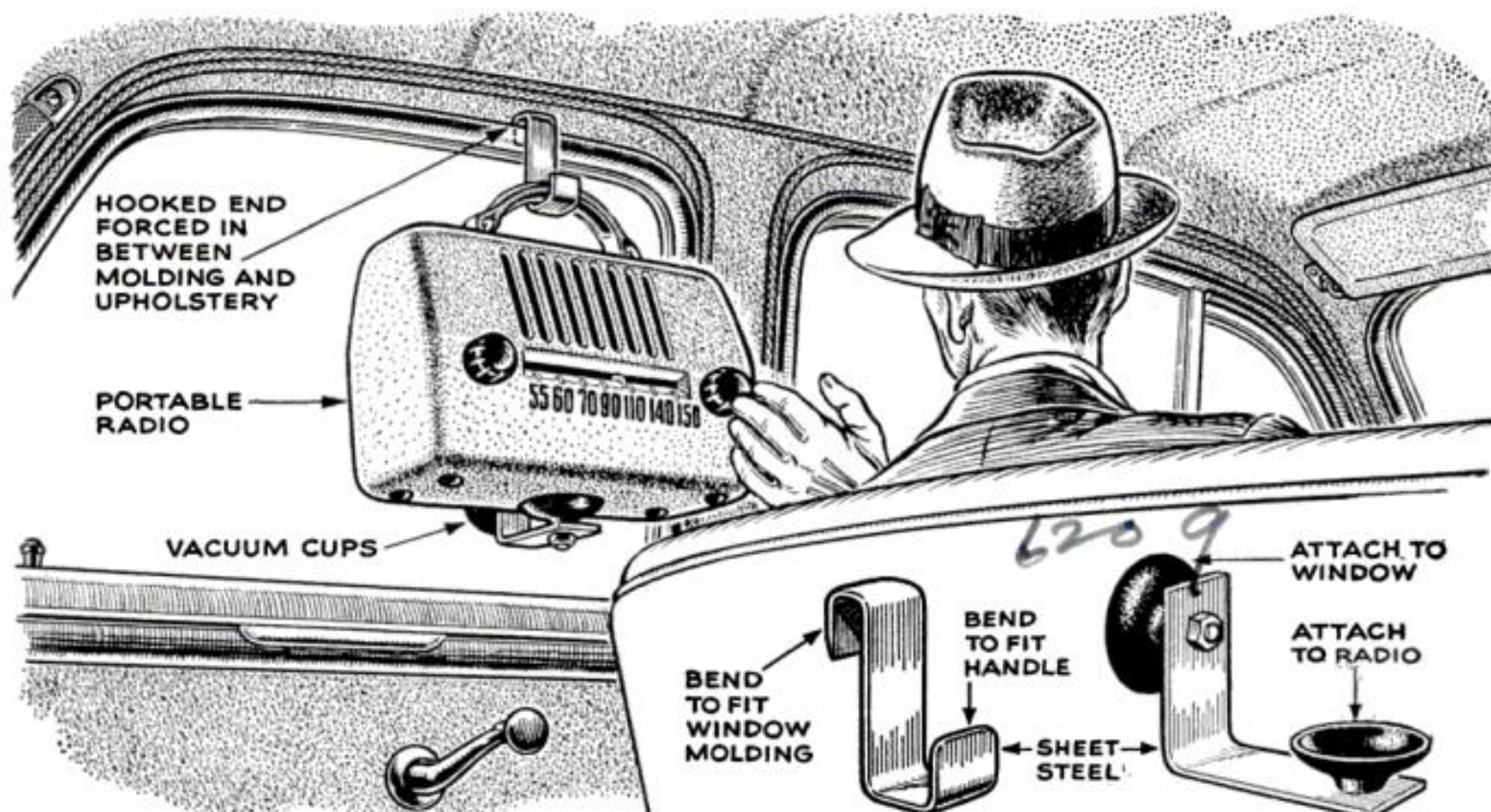
Cold Shackle Goes in Easily. Since cold contracts metal and hardens rubber, Robert Douglas, of Rochester, N. Y., suggests that you take advantage of this when installing Ford or similar spring shackles. Put the new ones into the freezing compartment of a refrigerator and leave for about half an hour. Then you'll find they have contracted enough to go into place with much less difficulty.

6309



Carrier for Truck Tire. When Edward S. Barrows, of Philadelphia, bought a pickup, the spare-tire carrier was missing. He remedied this by building the one illustrated from scrap materials. He writes that he finds this more convenient than the usual carrier under the box and that it doesn't interfere with any use of the truck. Should you want to carry an extra spare, a carrier like this might be the answer.

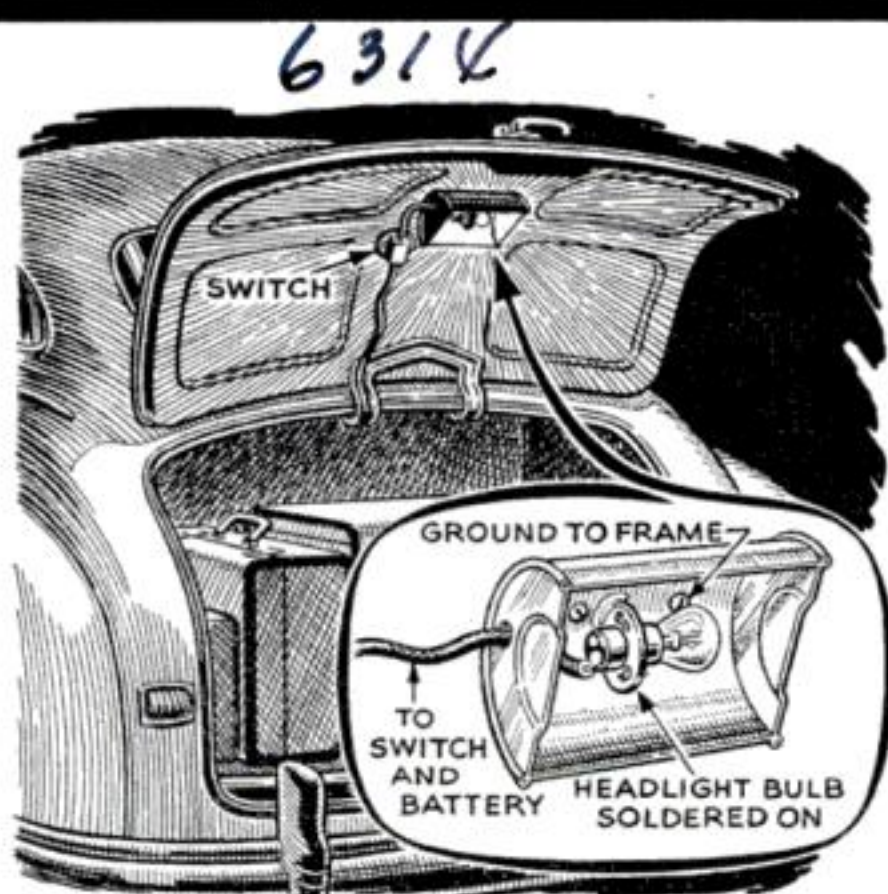
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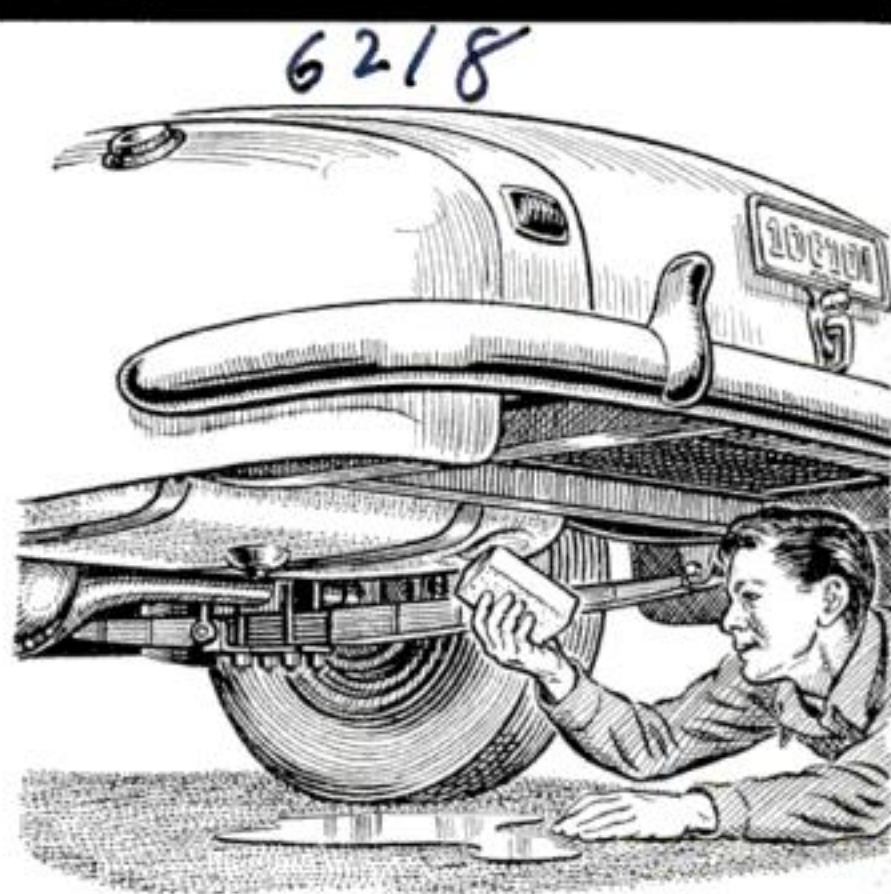
Portable Used in Car. Installed as shown, a good portable can double as a car radio. You'll notice that it can be quickly dismounted to serve in its original function.

With some sets two lower brackets may be necessary to provide firm support. Be

sure to moisten the suction cups before applying to the glass. Most portables will not equal the performance of a good car radio, of course, but an installation like this has been found perfectly satisfactory in areas where stations are not too distant.



Light Works Automatically. If your luggage compartment hasn't a light, here's one that you can install at little expense. Mount a mercury switch under the lid to close the circuit and turn on the light automatically when you lift the lid. Drop the lid, and it goes off. Tap a taillight wire for the hot lead, and provide a good ground contact from the reflector to the car. A tin can cut in half makes a good reflector.



Soap Stops Gas Leak. If carefully applied, a bar of soap will make an emergency roadside repair for a small leak in your gas tank. After locating the hole, wipe off surrounding dirt and grease and rub the soap firmly over the spot several times. Since gasoline will not readily dissolve soap, this temporary fix will usually last until you can get to a garage and have the tank repaired or replaced.

Engineering Your Own Midget Car

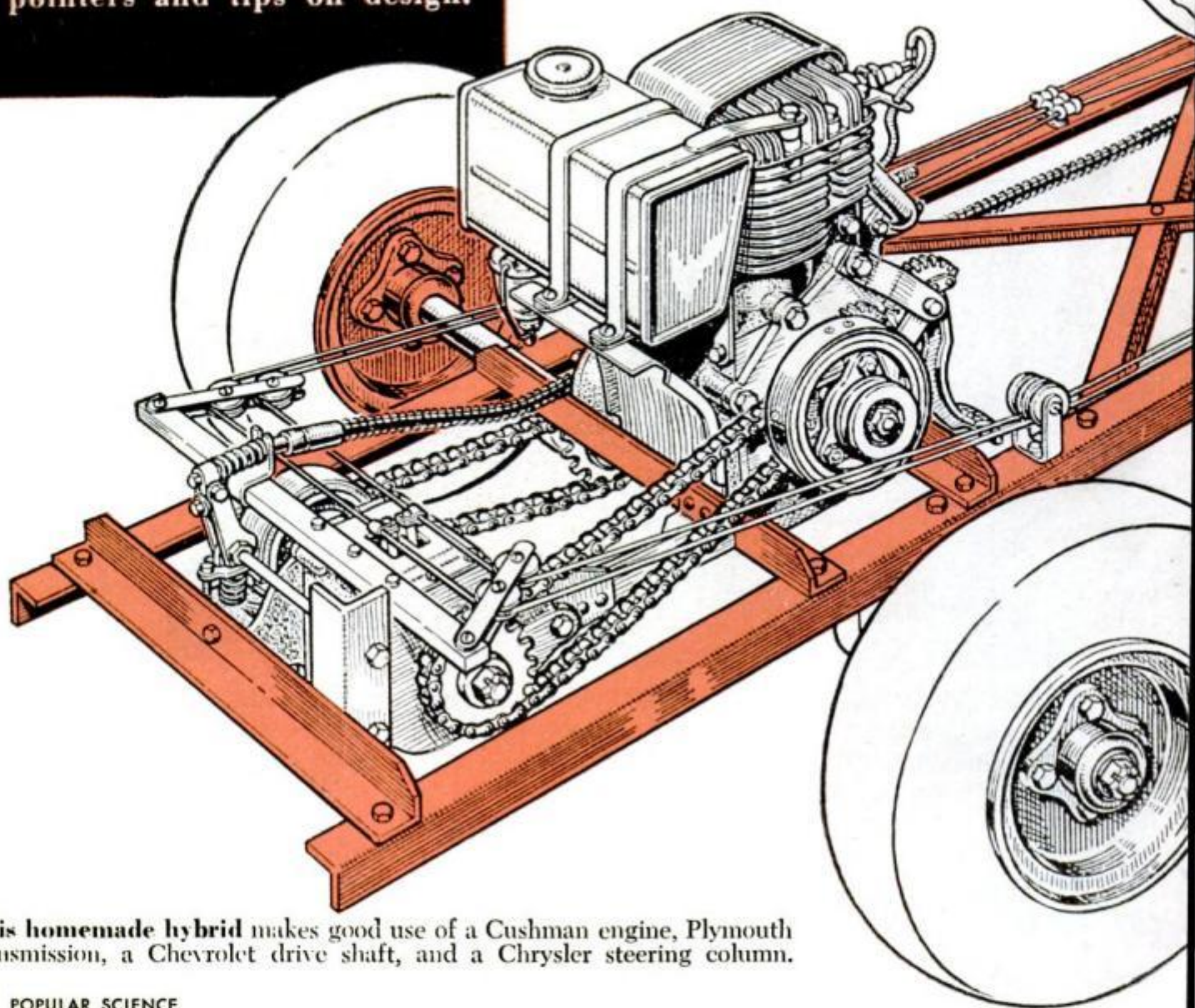
Tempted to build a tiny car around an air-cooled engine? This article gives practical pointers and tips on design.

IT'S not easy to look at one of the small air-cooled engines you can buy fairly cheaply these days without dreaming of building a midget car around it.

If you try it—and plenty of people have—you may end up with anything from an overgrown motorized coaster wagon of practically no utility to a slick little trick that'll do you proud on the highway. Which you get depends on a lot of factors, among them the time, tools, pocketbook, construction skill, and design sense you bring to the task. This article won't give plans for a specific car, since so much depends on the engine you use and the service desired. But it *will* give design pointers that the writer learned the hard way.

Your first, highly important job is some hard thinking about what you want. If the car is simply for casual jaunts in a spacious back yard or along level private roads, you can get by with a primitive design—say, a fixed pulley ratio, and perhaps no clutch.

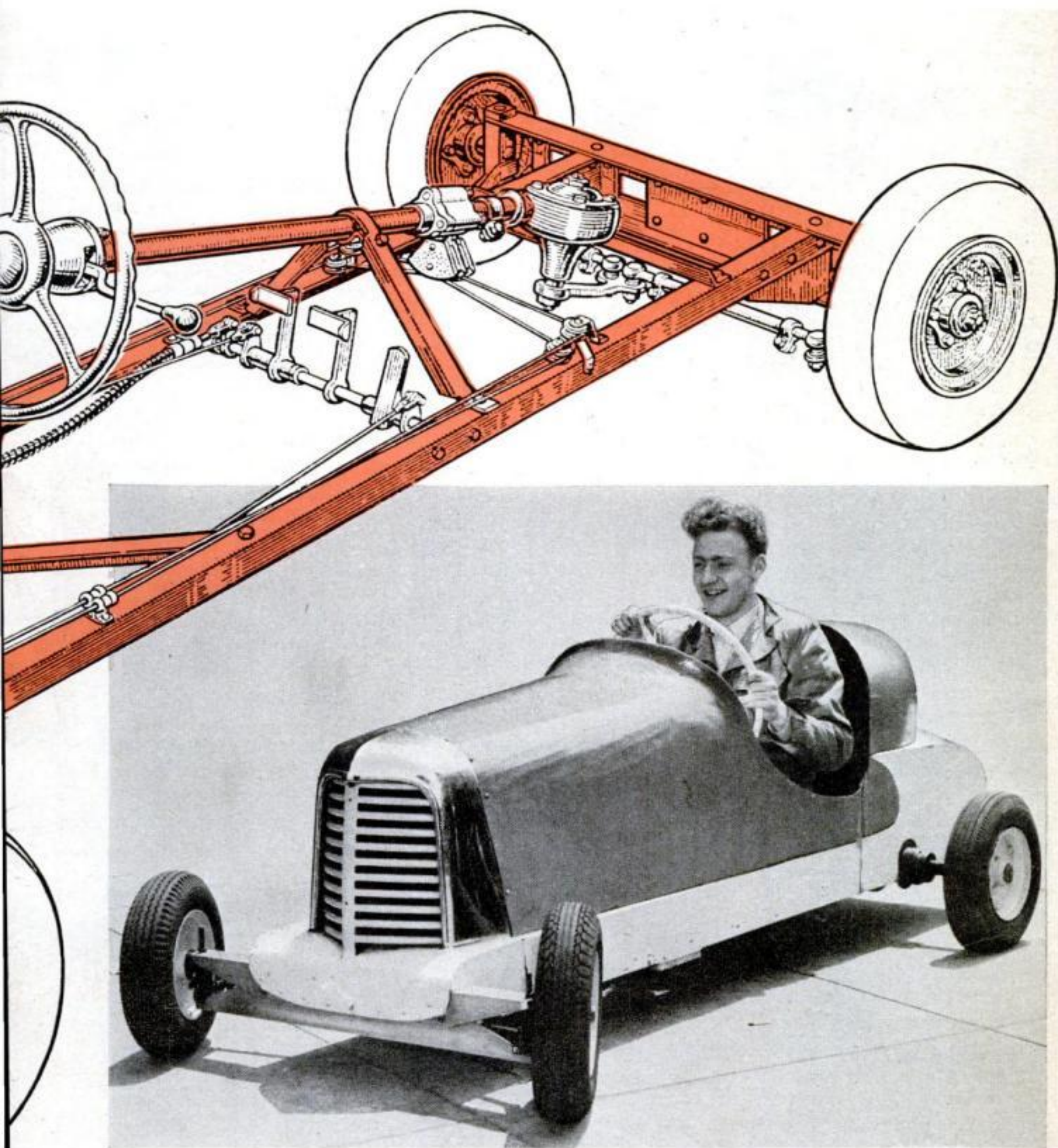
But if you're going to venture out on the



This homemade hybrid makes good use of a Cushman engine, Plymouth transmission, a Chevrolet drive shaft, and a Chrysler steering column.

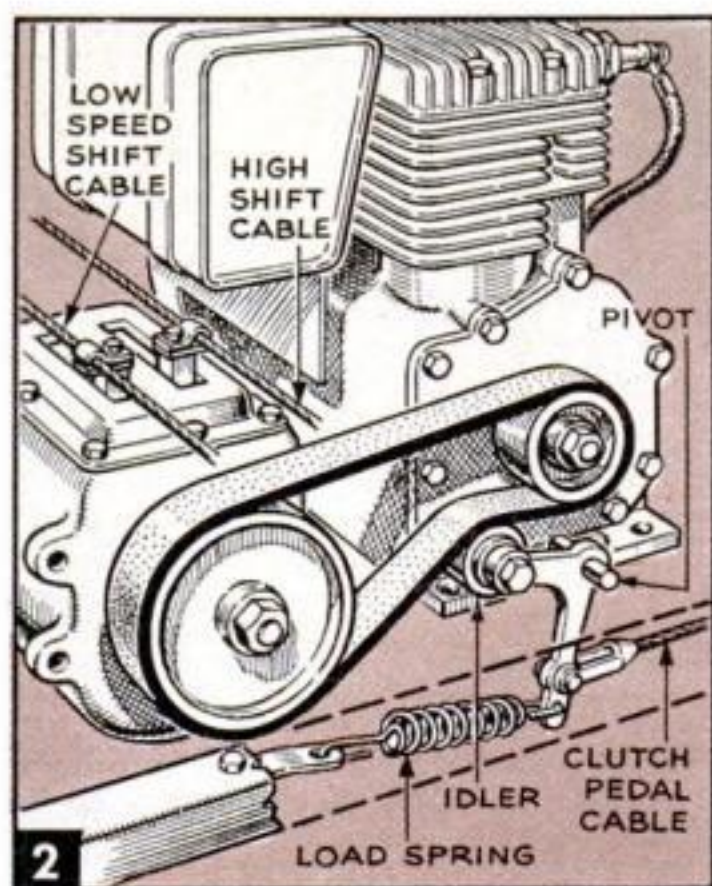
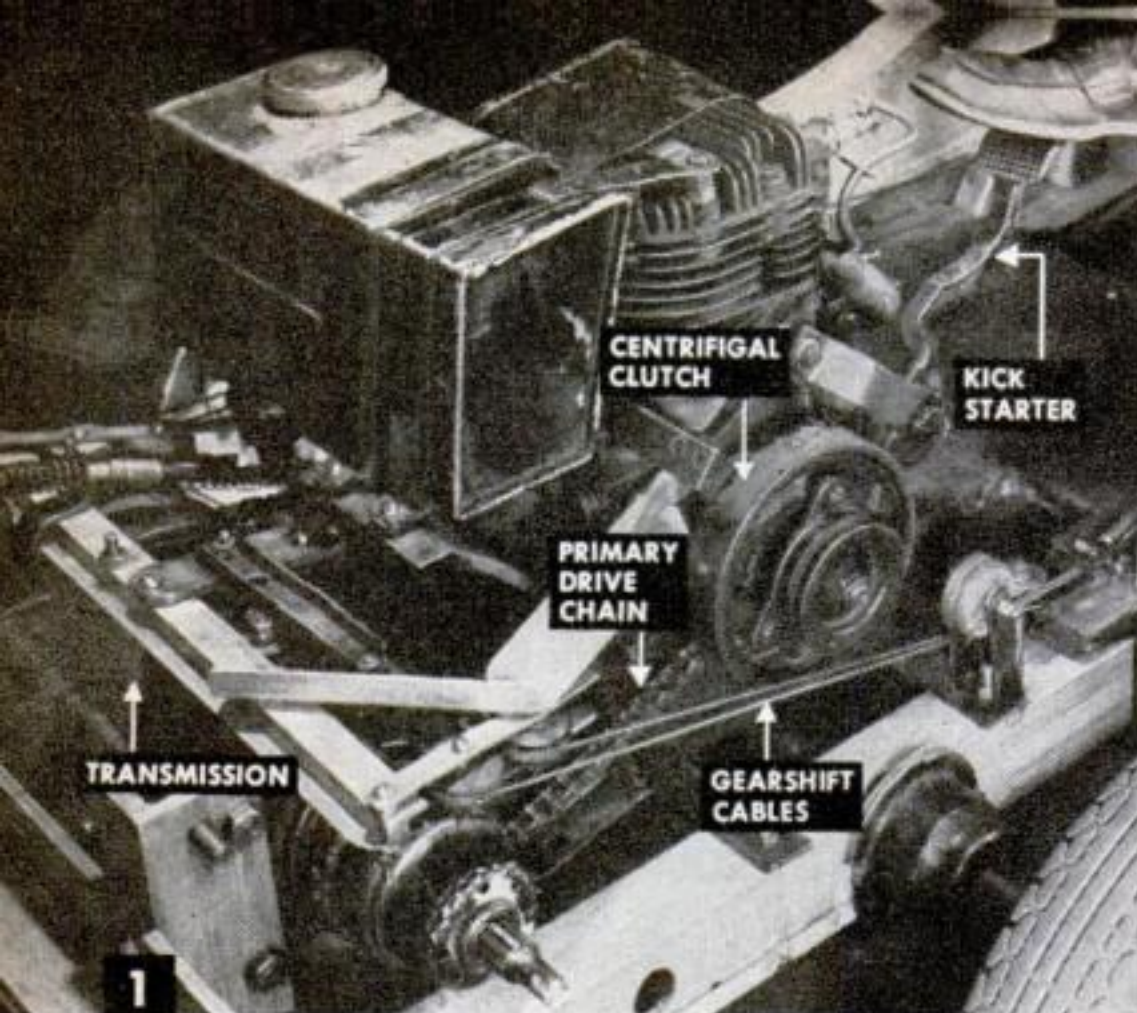
highways, where the car may mix it up with its big brothers from Detroit, you'll have to work harder. Not just because of the licensing requirements, either. You'll need good brakes, good lights, and reliable, flexible performance. Otherwise, the car won't be useful—or safe. If it's to go on the highway, it's just plain *got* to meet highway standards.

Most midgets are built around the engine, so let's begin there. Chances are you'll be using one of the common four-cycle, single-cylinder engines ranging from $\frac{3}{8}$ - to 9-hp. Here's a table that'll help you estimate the power needed, depending on the minimum top speed and hill-climbing ability you're willing to accept. (It assumes an overall weight of 450 lb., and allows for a 10



Clean sheet-metal work won't make a midget run better, but it will take a job out of the soap-

box class. Galvanized iron, judiciously pieced with junk-yard parts, produced this slick body.



percent power loss in the drive system.)

% Grade	HORSEPOWER NEEDED						
	Speed in m.p.h.						
	10	15	20	25	30	35	40
0 (level)	.6	1	1.6	2.2	3.1	4.3	5.8
5	1.2	2	2.9	3.9	5.0	6.6	8.5
10	1.9	3	4.2	5.5	7.1	8.9	
15	2.5	4	5.5	7.2	9.1		
20	3.2	5	6.8	8.8			

Next, you're ready to calculate the overall drive ratio to give most effective use of the engine's power. The problem is to select a ratio that will bring the engine to the speed where it gives greatest power when the car is traveling at the top speed obtainable from that horsepower. Figuring this calls for knowing (besides horsepower and road speed) the size of the drive wheel to be used and the r.p.m. at peak power. This latter figure, incidentally, is generally a bit less than peak r.p.m. Here's a table for an engine having a power peak at 2,800 r.p.m. and a drive wheel of the common 4 by 8 pneumatic wheelbarrow type:

Speed in m.p.h.	DRIVE RATIOS					
	10	15	20	25	30	35
Overall ratio (to 1)	13.4	8.9	6.66	5.33	4.45	3.8

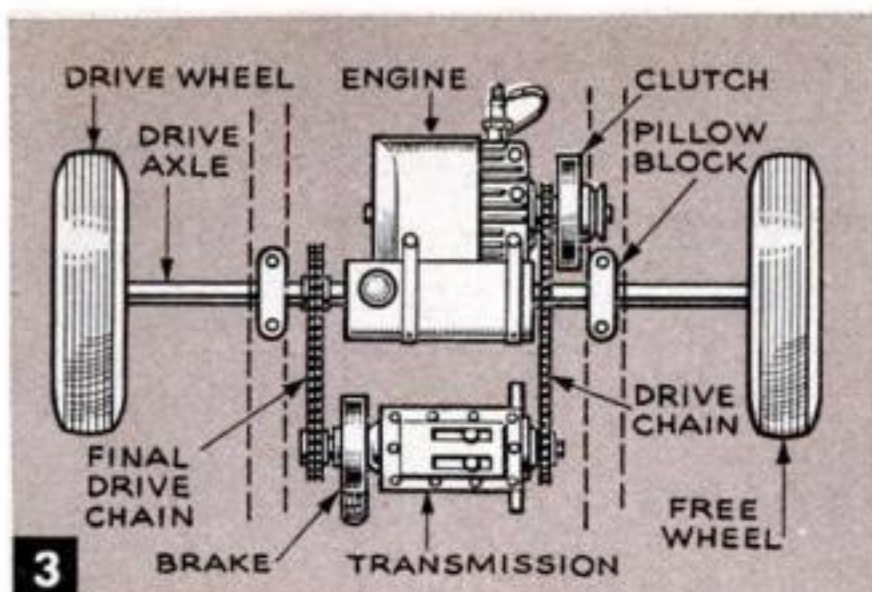
Let's assume you have a 3-hp. engine. The first table indicates it will drive a 450-lb. load at about 30 m.p.h. on a level road. The second table indicates the engine-to-wheel ratio in high gear should be about 4.45 to 1. And to take the same car up a 20 percent grade at 10 m.p.h., a ratio of 13.4 to 1 will be needed.

Obviously, variable gear ratios are needed for all but the most primitive cars, since a fixed one is necessarily a compromise between speed and power. This in turn means you'll need some kind of transmission and, in most cases, a clutch as well.

For a clutch, a commercial centrifugal one of the type shown in Fig. 1 is very useful. Employed on many motor scooters, it automatically disengages at idling speed, and applies power smoothly as the engine is revved up. Lacking such a clutch, you may be able to get by with idler-pulley or slack-belt clutch, such as is shown in Fig. 2. However, it'll need careful adjustment and will give trouble if allowed to get oily or wet. It may also slip under heavy loads.

A V-belt primary drive would give you less trouble with slippage, but you'll find it tough to get good clutch action with V-belts. They have a tendency to transmit power even when very slack, unless the outside of the belt system is caged to concentrate the slack over one pulley. Also the clutch may have a tendency to grab.

The power train shown in Fig. 3, incorporating a standard auto transmission, has much to recommend it. Being mounted transversely, the transmission acts as a countershaft. It permits the total 4.45 to 1 ratio to be divided into a 2.2 to 1 ratio from engine to transmission and a similar ratio between the transmission and rear axle. The attached parking brake provides a good means of stopping the car, and the lower gear ratios are valuable for starting and hill climbing. The reverse gear, though not absolutely necessary, will often be handy.



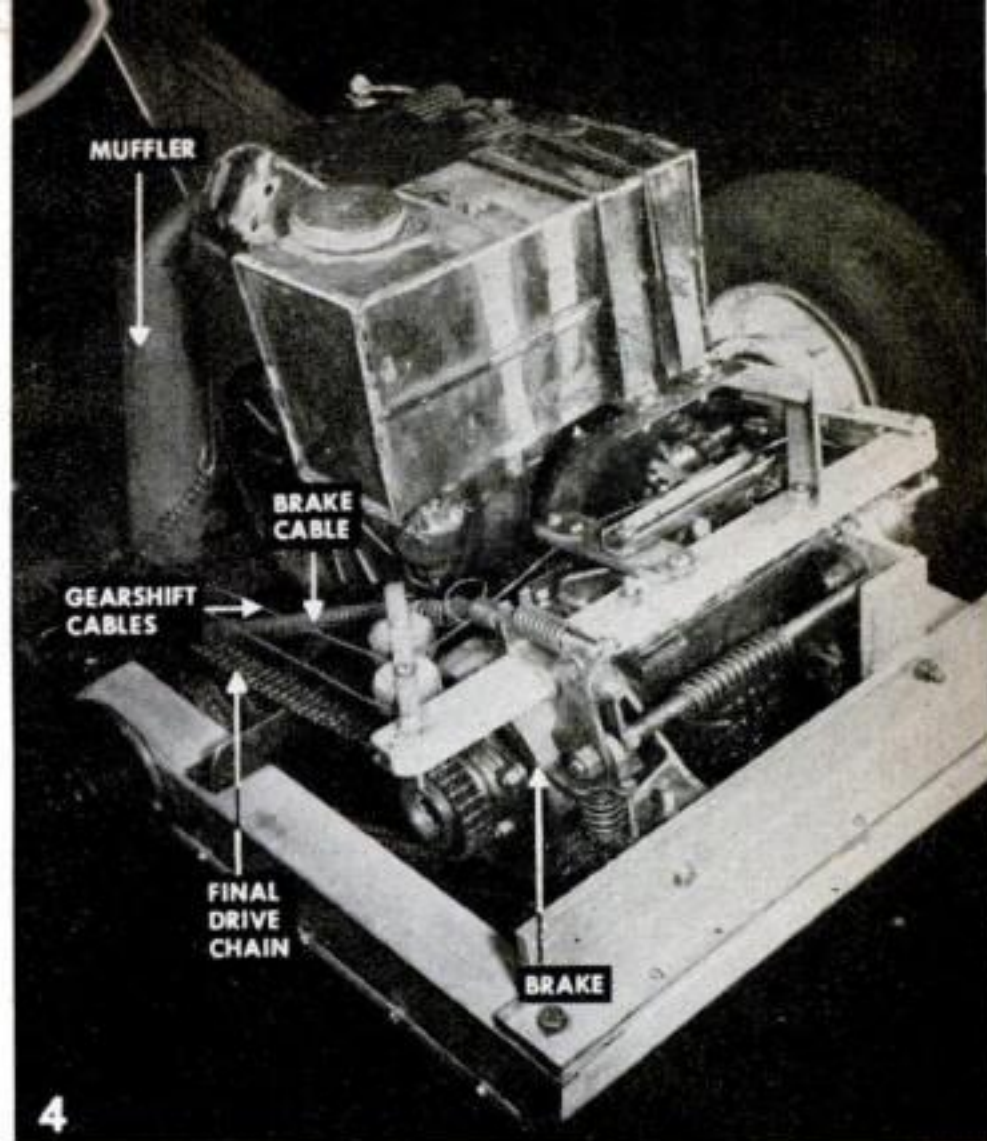
Figures 1 and 4 give details on such a setup. Note that the transmission is controlled by cables clipped to the shifter forks.

If you're willing to dispense with reverse gear, a motorcycle transmission may be the answer. It incorporates a clutch, and it's lighter and smaller than a car transmission. You'll have to devise a separate braking system as in Fig. 5.

A regular auto differential is far too clumsy for most midgets, and yet some arrangement is necessary to let the rear wheels "corner" at different speeds. One answer is to drive the left wheel only. On the car shown here a $1\frac{1}{2}$ " drive shaft running in ballbearing pillow blocks acts as a live rear axle. Splines at the left drive that wheel through a welded sleeve; the other wheel floats on $\frac{3}{4}$ " roller bearings.

As for springing, much depends on the roads the car will use and the type of wheels employed. In the writer's experience, 4 by 8 pneumatic wheels provide all the "springing" needed on smooth roads at modest speeds. But if springing is desired, study the details sketched in Figs. 6 and 8. Experiment with the stiffness of the coil springs in the rear and the number of leaves in front to produce the best ride. If you employ springs, be sure to allow for the effect of axle movement on the final-drive chain in the rear, and on the steering linkage in the front. Also make provision for braking thrust and torque.

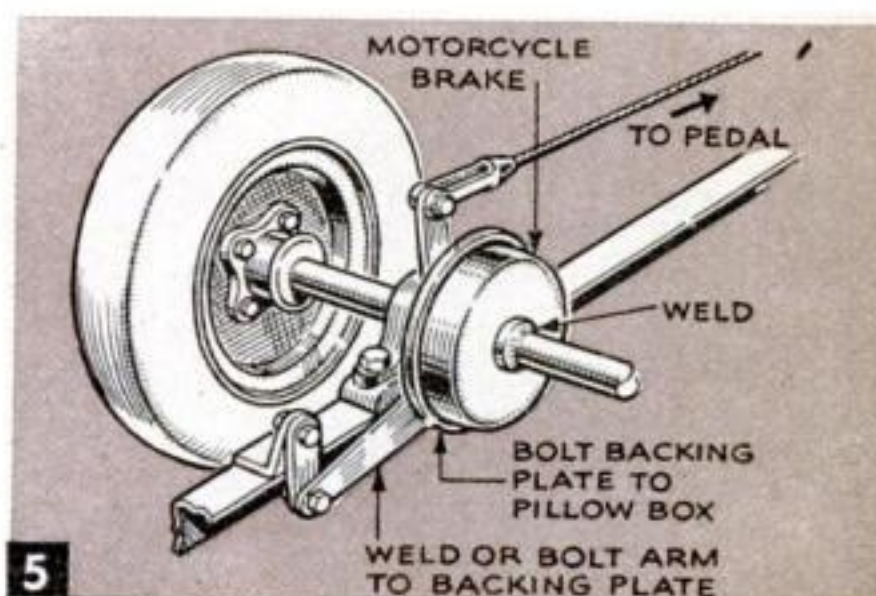
Steering geometry and front-end construction may be simplified by a study of Figs. 7 through 12. The most important consideration is to have the inner wheel on a turn cut in at a sufficiently sharper angle than the outer wheel. (This is necessary because the inner wheel travels a smaller circle than the outer one, and it must reach and maintain this lesser radius if it's to avoid side-wise tire drag and wear.)

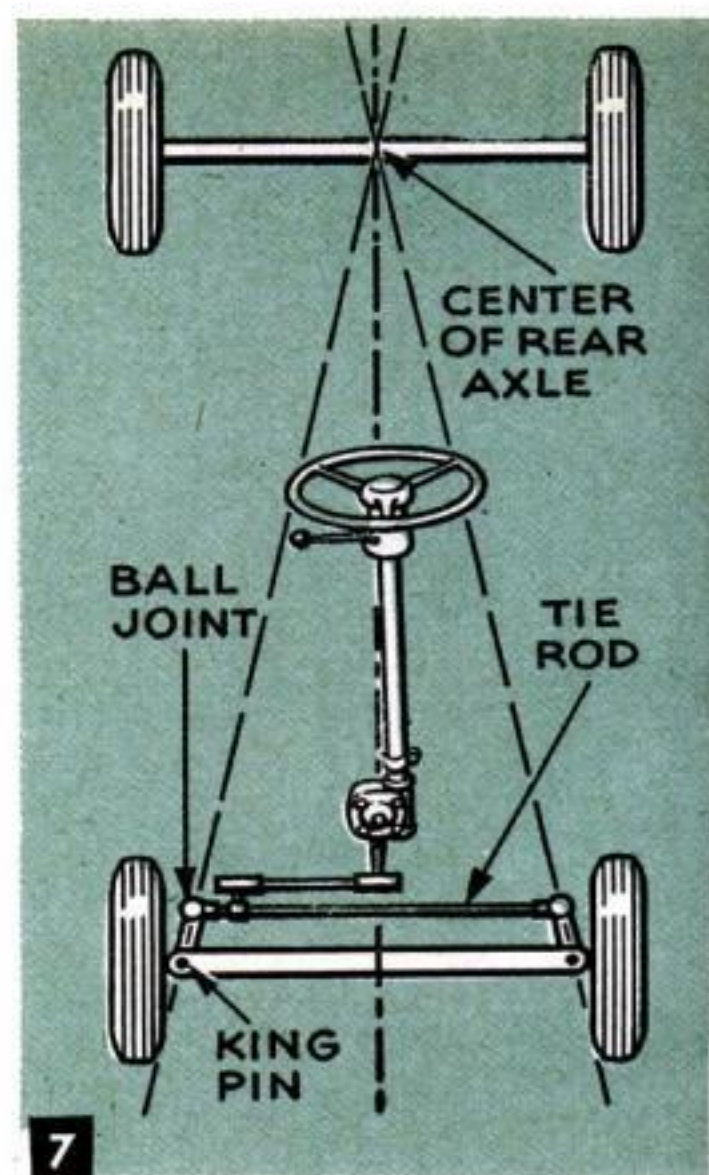
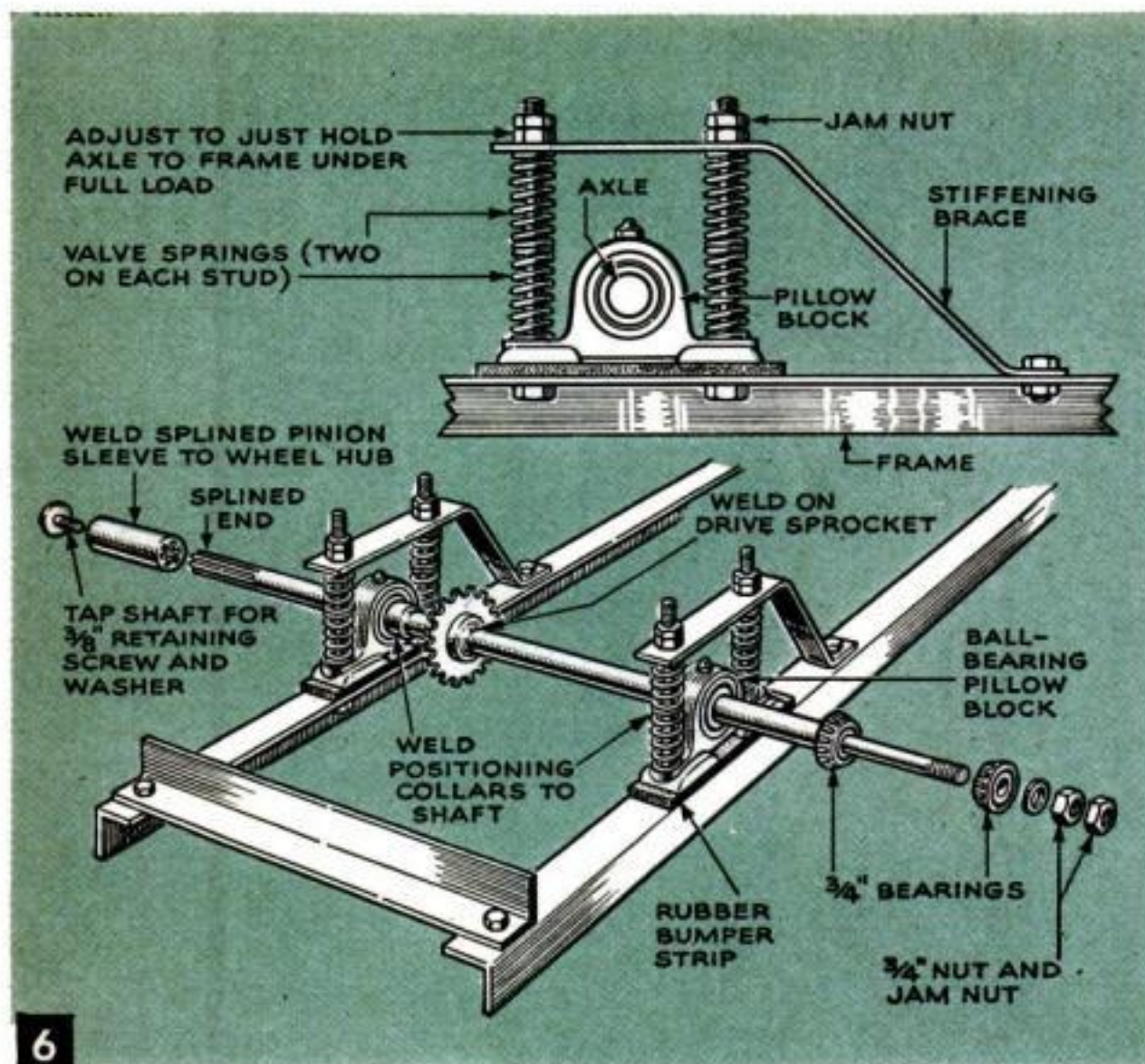


The correct angles will be approximated at all times if the steering is designed as in Fig. 7, with the two steering-knuckle arms pointing to the center of the rear axle when the front wheels point dead ahead. Be sure the king pins and their tie-rod ball joints are at that time accurately aligned with the center of the rear axle.

A wheel spindle may be built up by driving a turned steel shaft into a turned or tapped steel block. The resultant knuckle assembly must be permanently strong, so use a heavy drive fit that's pinned and peened or welded. The ends of the block may be either drilled and tapped, as in Fig. 8, for a sprung front end, or turned to give kingpin studs, as in Figs. 9 and 12. Steering-knuckle arms could be angle sections bolted and welded in place, or steel shafting driven into the blocks and secured in the same way as the wheel spindles.

Accurate and reliable steering control

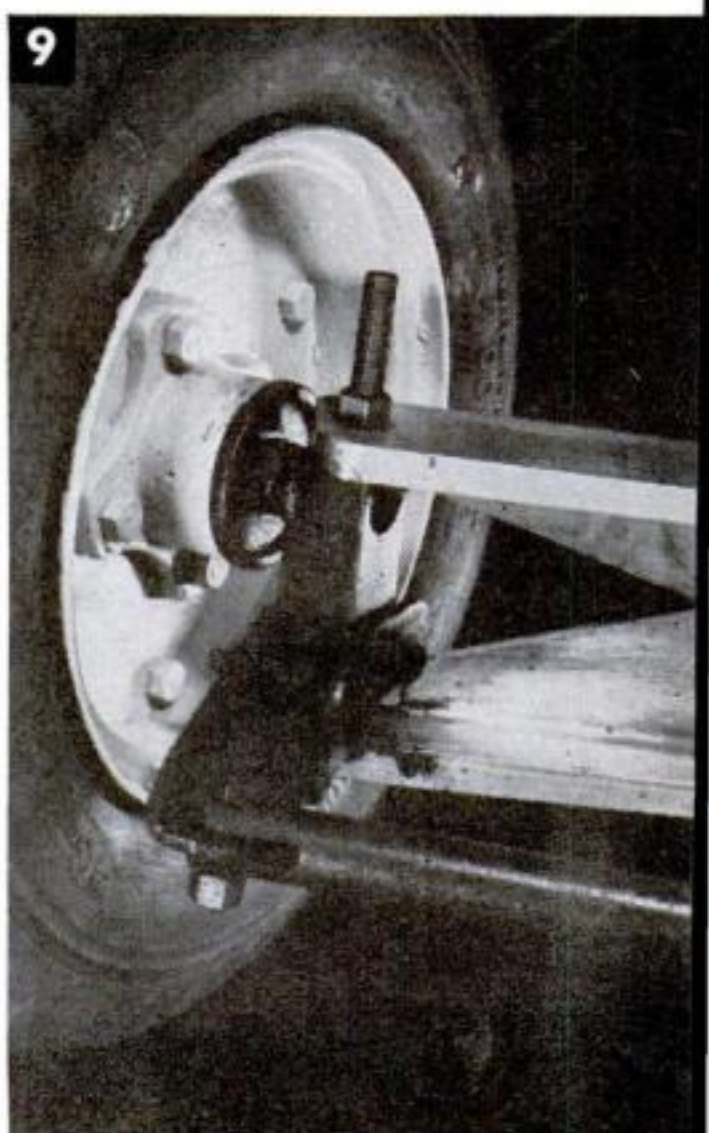
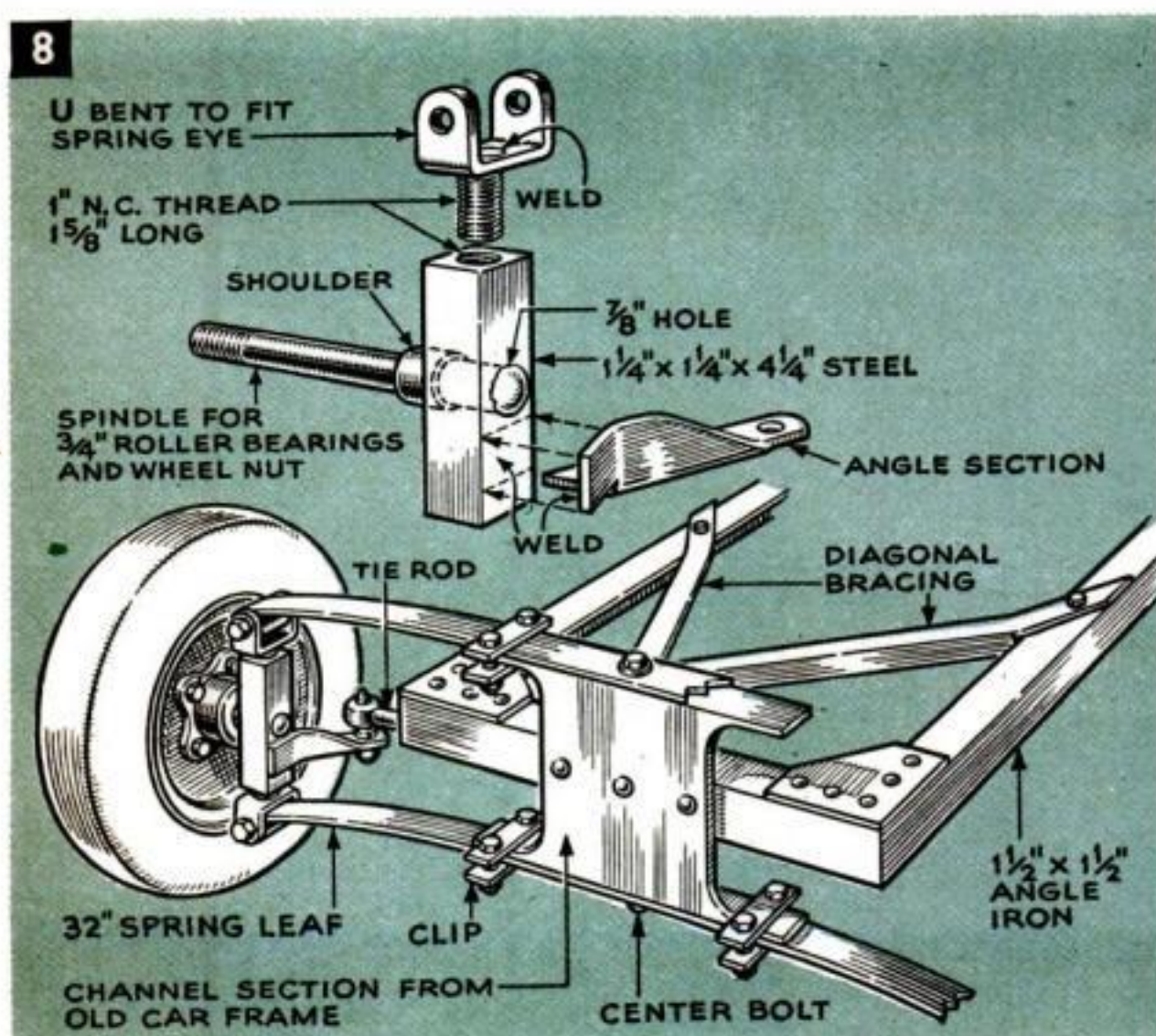




calls for a cut-down steering post and gear from a regular car, preferably of the type that uses a drag link parallel to the axle. Try to obtain one that's fitted with a shift lever, since this will simplify transmission control. Methods of mounting and bracing the gear are suggested in Figs. 10 and 11.

And don't skimp on the job of safetying the entire linkage, preferably with castle nuts and cotter pins.

Throughout the construction of the car (and especially if you choose a sprung front end), you'll run smack into clearance headaches. For instance, the steering drag link



must obviously clear the frame in all steering positions and all loads. It is a good plan to dope out clearances on paper as far as possible ahead of time. Another good scheme is to prop up the parts in approximate position before you weld, cut, drill, or otherwise commit yourself.

Light structural-steel angle stock with welded joints will make an excellent chassis, as will somewhat larger aluminum-alloy angle. With steel you will need to strike a nice balance between insufficient rigidity and excessive weight; with aluminum the problem will mainly be to get secure bolted or riveted joints. Try to employ angle stock in the ways that will give maximum stiffness; the paired pieces that make up the front axle in Figs. 9 and 12, for instance, act almost as a box or channel section and combine lightness with strength.

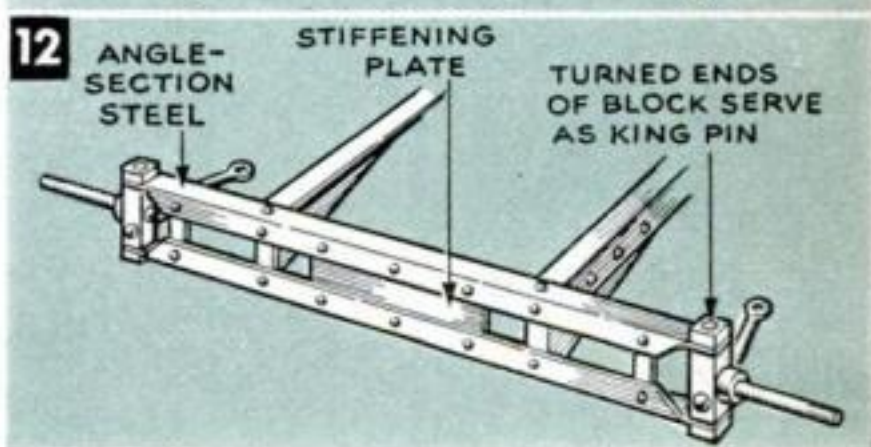
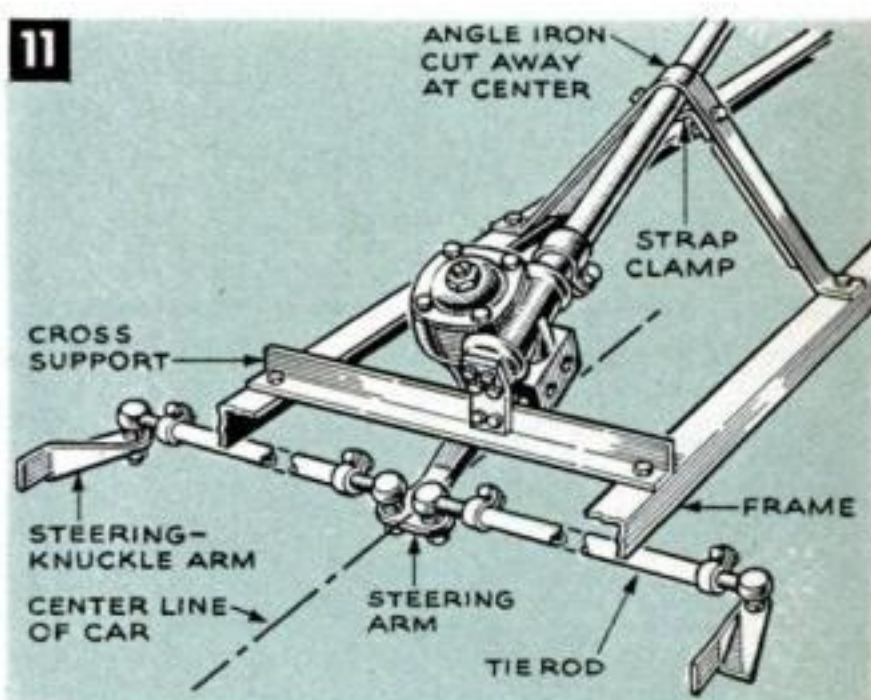
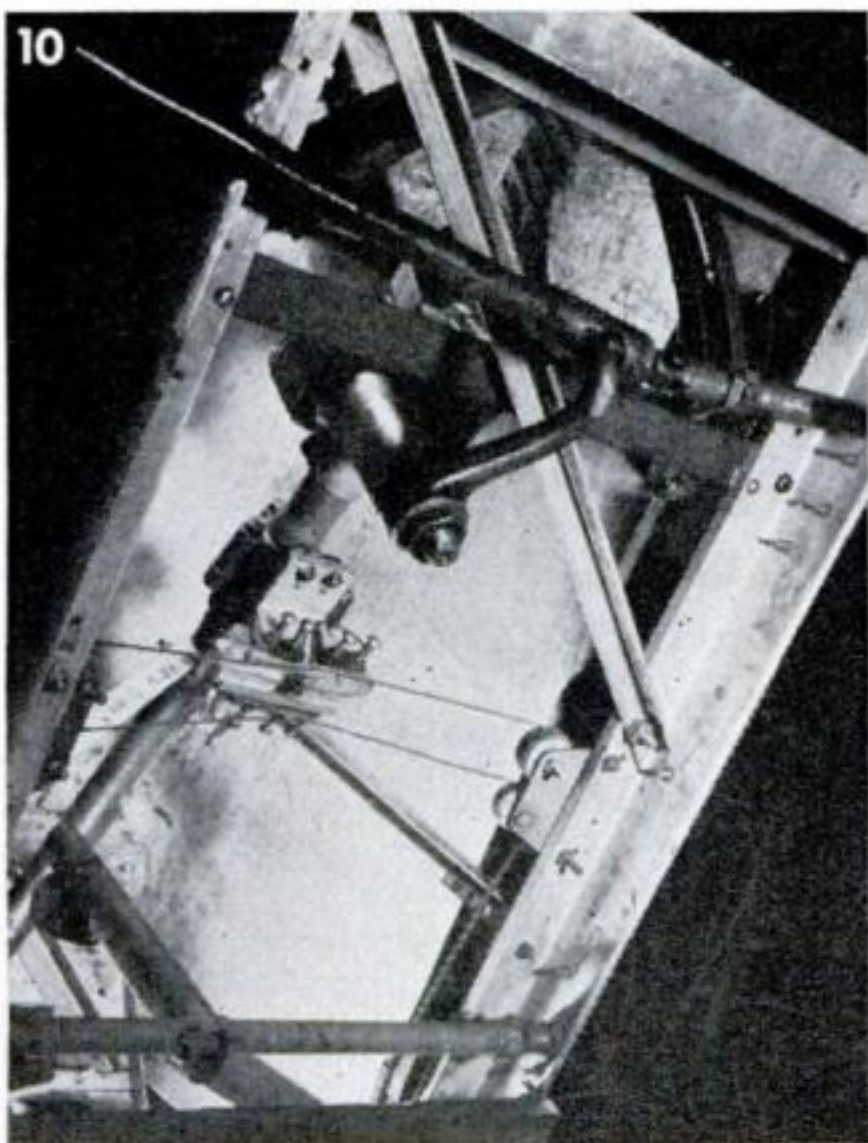
The location of the engine is up to you, but rear mounting has much to recommend it. Simplicity, compactness, and less heat and noise are among its advantages. Don't let the wheelbase and tread creep beyond modest dimensions. One way to determine the shortest wheelbase that will serve is to prop up the engine, transmission, and other major parts in approximate position on the shop floor. Then measure off what's needed to make a comfortable driver's compartment, chalking off the area occupied. You can now make a good estimate of the shortest wheel-

base that will still fit everything in. As for the tread, the proportions will be about right if it is approximately half the wheelbase.

A nicely engineered chassis deserves a good body. You'll simplify things if you hold compound curves to a minimum. Either sheet aluminum or galvanized sheet iron will serve. Such compound curves as are necessary can be had by cutting and piecing sections trimmed from big-car fenders.

It's probably evident by now that you'll gain by a familiarity with local auto graveyards. Other good supply sources are war-surplus outlets; 3/32" flexible steel aircraft cable, for instance, is fine for transmission controls. Motor-scooter and motorcycle shops will also help out, especially for horns and lighting systems.

Finally, keep in mind the "little things"; if you neglect them, they won't seem so little. Be sure the engine will get enough cooling air. Provide easy access to the fuel tank and oil plug. Leave enough space for the kick starter or pull rope. Protect drive chains or belts from gritty puddle splash, and don't forget that unfendered front wheels can sling a mean mud bath. Use a muffler that really muffles—a noisy engine will set your nerves on edge. And be certain that all chains, belts, and hot tailpipes are shielded from stray fingers.—Roy M. Howell, St. Albans, N. Y. 118-08 22nd St.





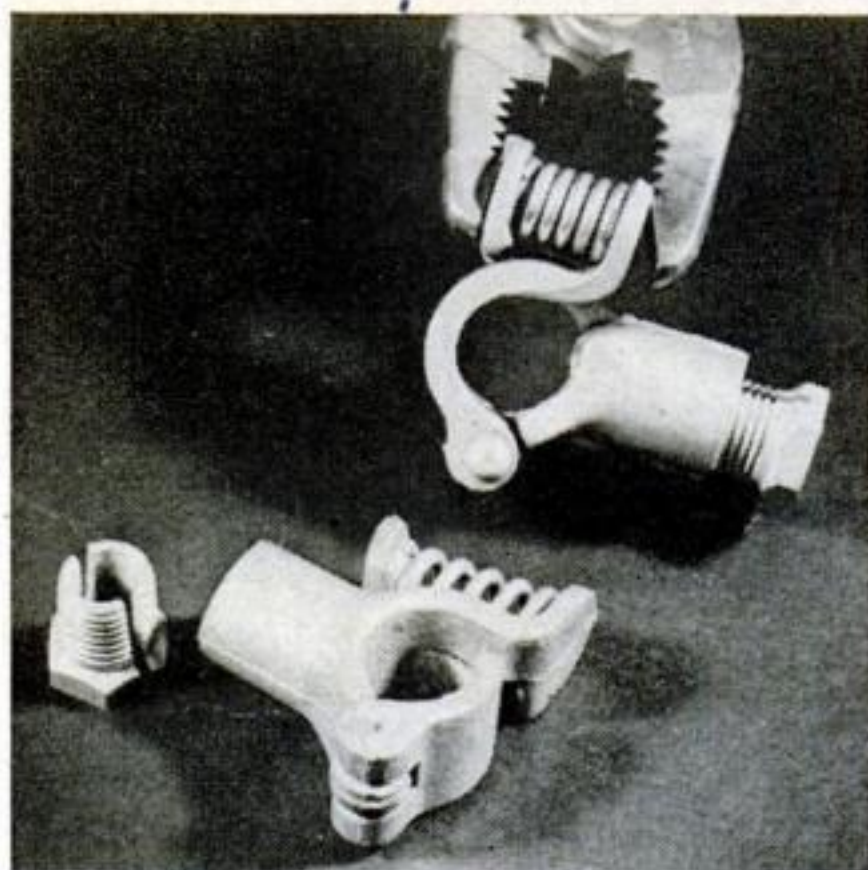
New "Chains" Have Ice Cleats

DETACHABLE ice cleats are a feature of new mud hooks made by Birma Manufacturing Co., Inc., Buffalo, N. Y. Called Gripco Individuals[®], they have a slotted rubber tread and are drawn tight with a screwdriver. The ice cleats are channel shaped and have sharp teeth along each edge. To install them, you slacken the rubber tread and slip a cleat through the slot so it straddles the rubber. The hooks retail at about \$7.40 for a set of four. The cleats are extra, about 85 cents for a set of eight.

Fog Lenses Fit on Headlamps

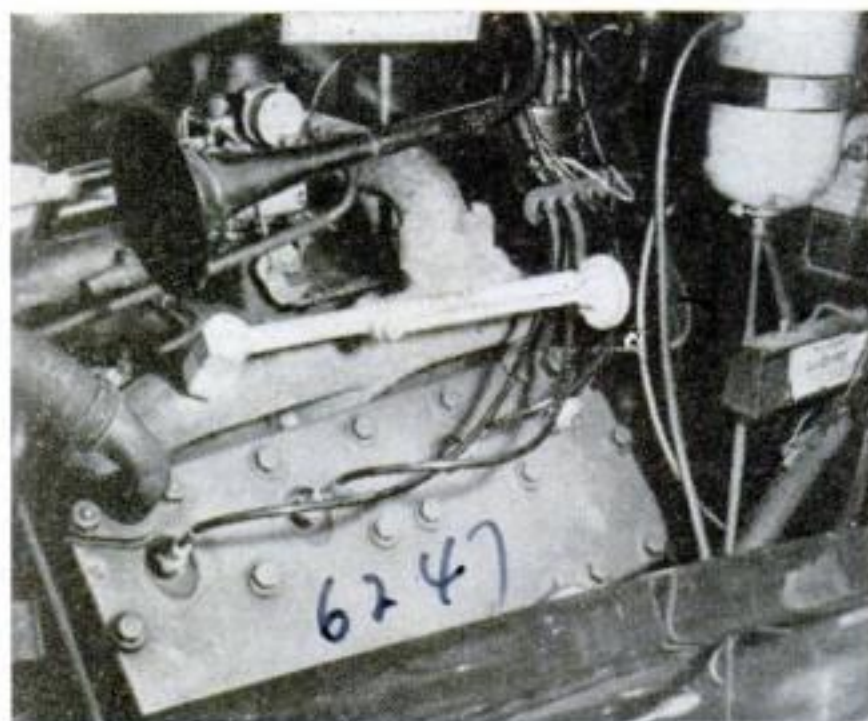


HERE'S a way you can quickly turn your headlights into fog lights when the need arises. Amber-colored plastic lenses sold by the Miller Rubber and Plastic Corp., of Detroit, for about \$2 a pair fit directly over the regular headlights. Small enough to carry in your glove compartment, they're installed by pressing a rubber suction cup against the center of each headlight lens. The amber lens is then drawn tight with a nut.



Pliers Remove New Terminals

REGARDLESS of vibration, a spring clamp keeps this new auto-battery terminal in tight contact with the post. It's removed or attached by compressing the spring with pliers. To install, you sandwich the bare end of the cable between the two halves of a split nut and screw up the body of the clamp. James A. Stanley Co., New York, makes the terminals, which are about 60 cents each.



Gadget Dilutes Exhaust Gases

BY ADMITTING air into the exhaust manifold, a new automobile accessory is said to help overcome harmful effects caused by exhaust gases drawn back into the cylinders. One claim is that the air-gas mixture tends to reduce carbon deposits on the valves. Developed by the DeLuxe Products Corp., La Porte, Ind., the gadget is installed on the exhaust manifold. Valves prevent the direct escape of exhaust gases.

Mechanics and Handicraft

REG. U. S. PAT. OFF.

<i>Tree Ornaments from Tin Cans</i>	PAGE 198
<i>Gift Wrapping for Men Only</i>	PAGE 184
<i>Doll House with Electric Light</i>	PAGE 190
<i>Home Press Laminates Plastic</i>	PAGE 204
<i>Taking Apart a Glass of Milk</i>	PAGE 234



Snip some angels from tin cans to brighten up your Christmas tree. See page 198.



These packages are wrapped with easily handled materials—tough paper, strong cord, and

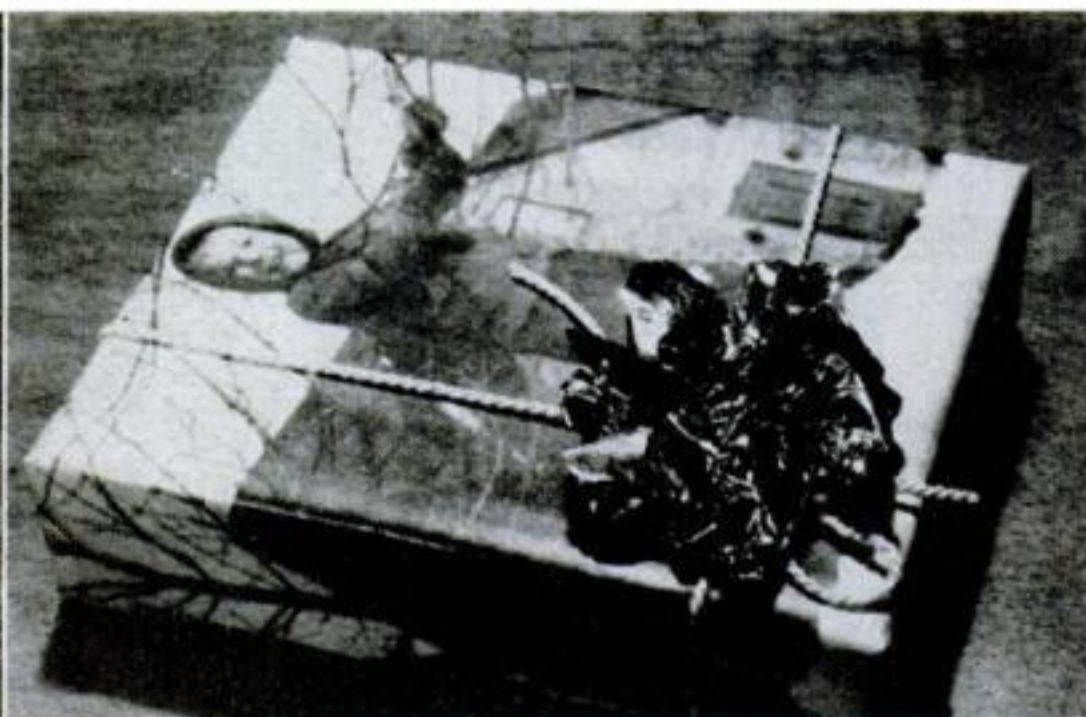
wide cellulose tape. The two little bells on the box at right are from a dime-store baby's rattle.

6304 Gift Wrapping for Men Only

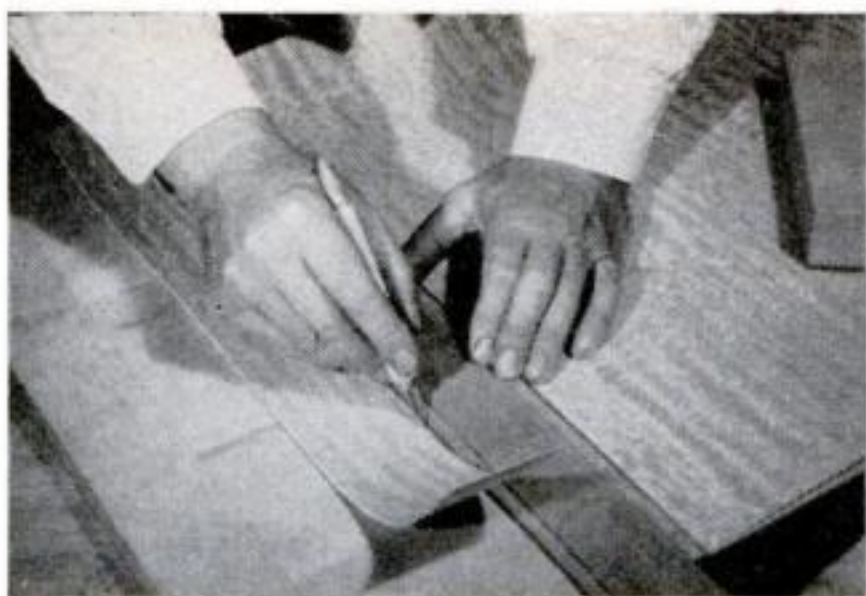
Here's how to lick this Christmas chore without tangling yourself in yards of red ribbon. Use he-man materials and stay away from frills.



Plastic on the job. The paper is plastic-coated, the flower is plastic held by plastic cement.



For photo fans. The wrapper is a tinted print decorated with foil from a box of roll film.



1. Cut the paper for a $\frac{1}{2}$ " lap around the box and just long enough to fold neatly over the ends.



2. Place box face down. Anchor the paper with a seal, cellulose tape, or fast-setting cement.



3. Fold the corners first, mitering them neatly. Fasten the flaps with more seals or cement.

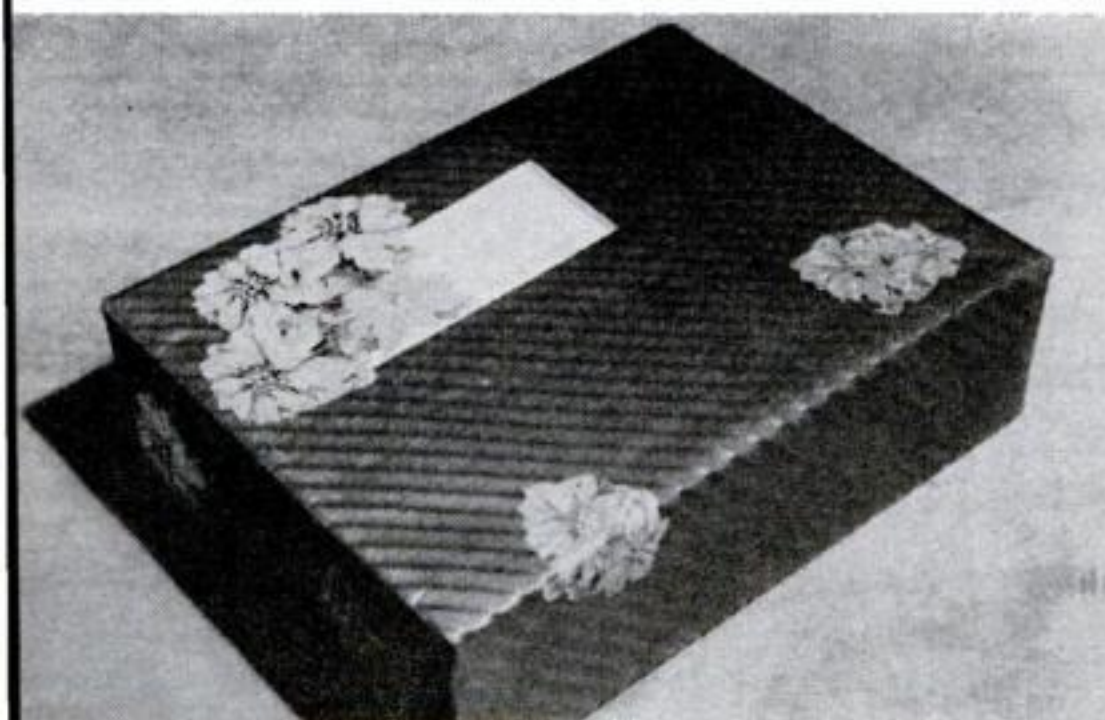


4. Now put on some more seals and add colored cord, evergreen sprigs, or other decoration.

BEGIN your gift wrapping this year by tossing out conventional notions. Tissue paper isn't necessary, colors needn't be red and green, and fussy frills aren't musts. Pick some rugged paper and go to work.

Don't try to wrap unboxed, irregular-shaped gifts—you're apt to wind up with a lumpish, turnip-shaped job. And avoid us-

ing too big a sheet of paper; the bunched ends will look like an unmade bed. Instead of fragile tissue, get some tough, colorful paper that won't tear at a touch. Fasten with colored cellulose tape or bright, strong cord. Splash on plenty of Christmas seals and finish off with sprigs of evergreen or dime-store bells.—*Will Thomas, Kenmore, N. Y.*



This one is simple, using ordinary gift paper held by seals. Seals hold the name card, too.



For mailing, pack gifts in shipping cartons. Note cardboard collar to protect decoration.



Carousel Horse Decorates Nursery Lamp

6236

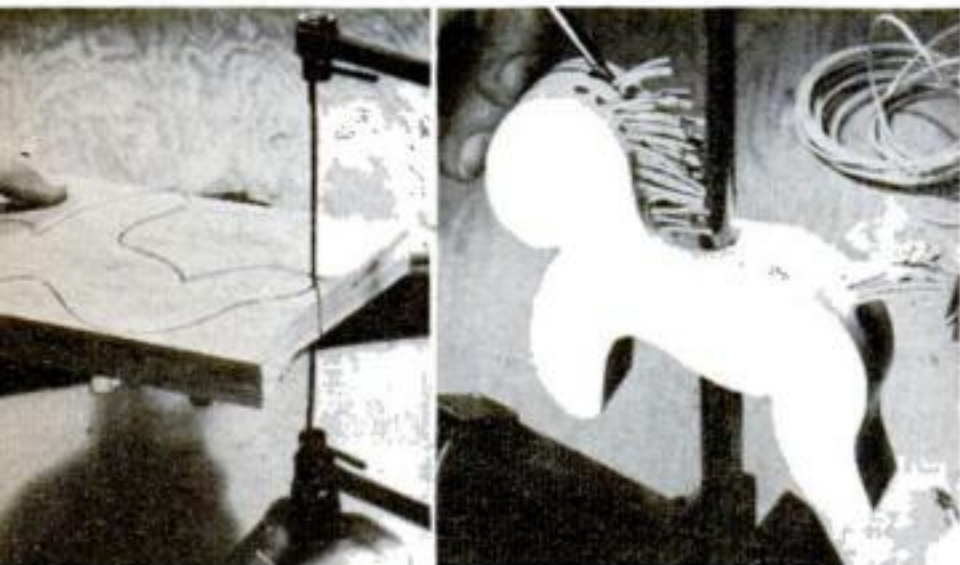
A QUICK hit with the younger set, this merry-go-round lamp is a double-barreled gift because it will also please parents. Finished in the brilliant colors kids like, it looks much slicker than its hand-tool origin suggests.

Saw out the base and horse from $\frac{3}{4}$ " stock or thicker, preferably plywood. Bore and counterbore the base and cut the groove for the cord. Drill the necessary holes, sand well, fill the edges, and apply white enamel.

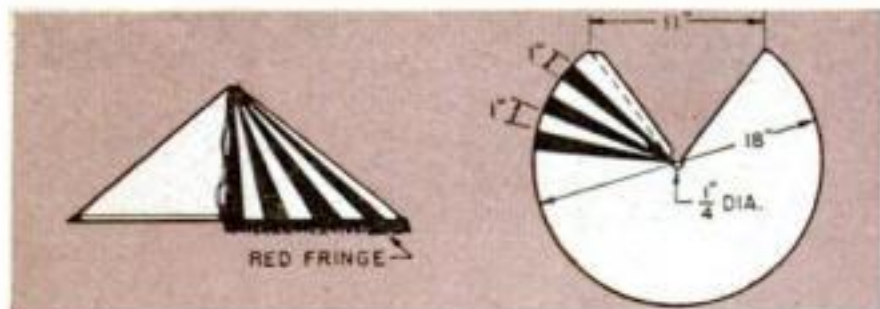
Cut a 9" length of $\frac{3}{8}$ " brass tubing and thread both ends with a $\frac{1}{8}$ " pipe die. Make a threaded 1" washer for the lower end. Polish both parts bright and dip in clear lacquer. The finial is simply a brass ball and wire with a red plastic pennant.

I used round plastic cord for the mane and tail, held in the holes with cellulose cement. Colored yarn would also do. Paint in the eyes, bridle, and saddle. The edging on the base is bright plastic cord. Use heavy drawing paper for the shade, striping it with poster paint. Form the hoop of No. 10 wire, wrap with red cloth tape, and cement inside the cone.—Bill Luther, Los Angeles.

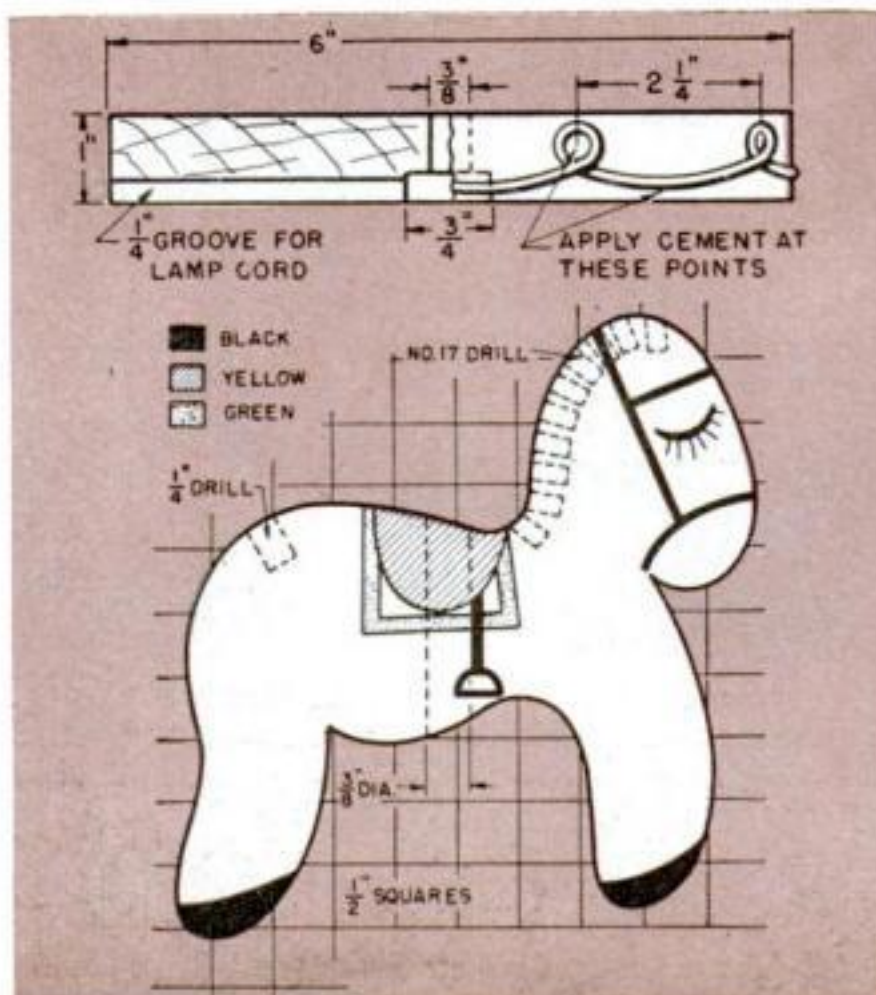
With a debonair prance, the plywood horse rides its shiny brass pole. A red wool fringe is sewed to the edge of the drawing-paper shade.



Cutting the horse is a straightforward coping-saw task. At right above the mane is cemented in blind holes. If the horse proves loose on the pipe, put cellulose tape on the pipe first.



Heavy drawing paper makes a fine shade. Step off the inch divisions with dividers and use poster paint. Spring clothespins, right below, help cement the wire hoop to the shade edge.





Here are before and after pictures. The hanging shelves do not take up any floor space, so the studio couch may be pushed against the wall. Note fluorescent reading lamps.



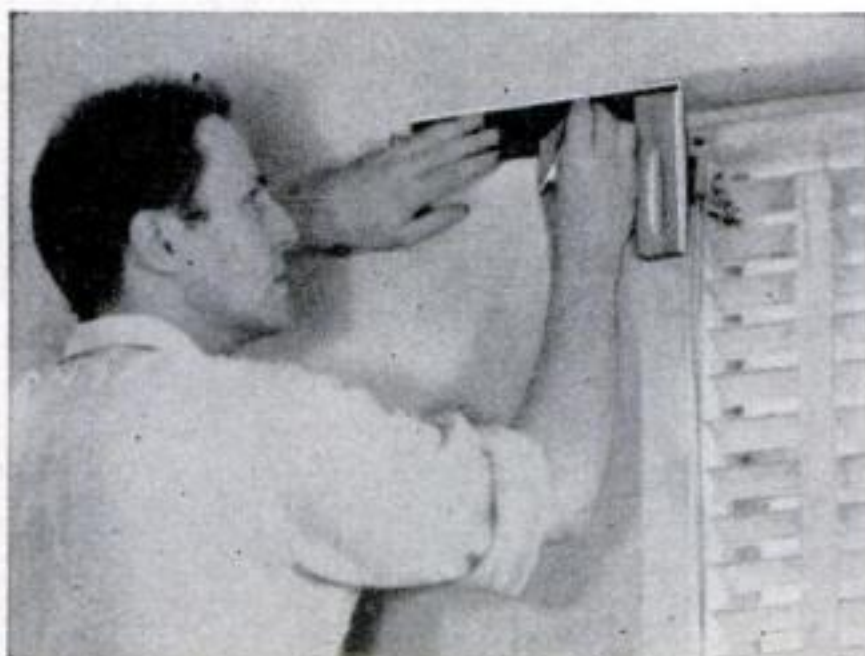
Hanging Shelves Put Up in One Evening

6280

REGULATION showcase equipment—knife brackets and knife standards—form the principal parts of these quickly built bookcases that have neither sides nor fitted joints. Besides brackets and standards, you'll of course need wood for the shelves and perhaps a plywood panel. I added fluorescent reading lamps beneath each bottom shelf.

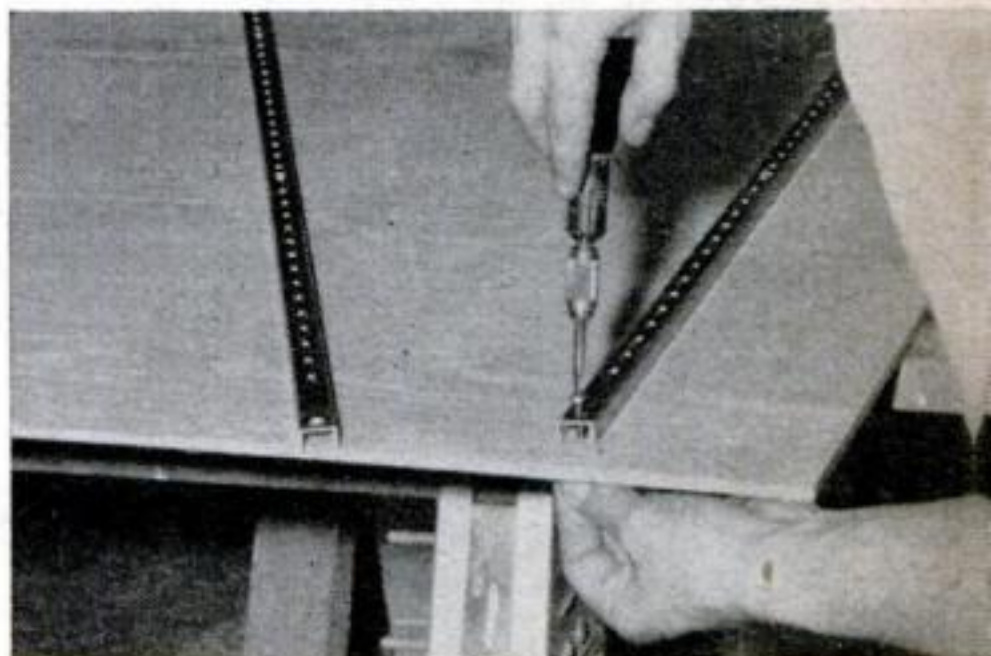
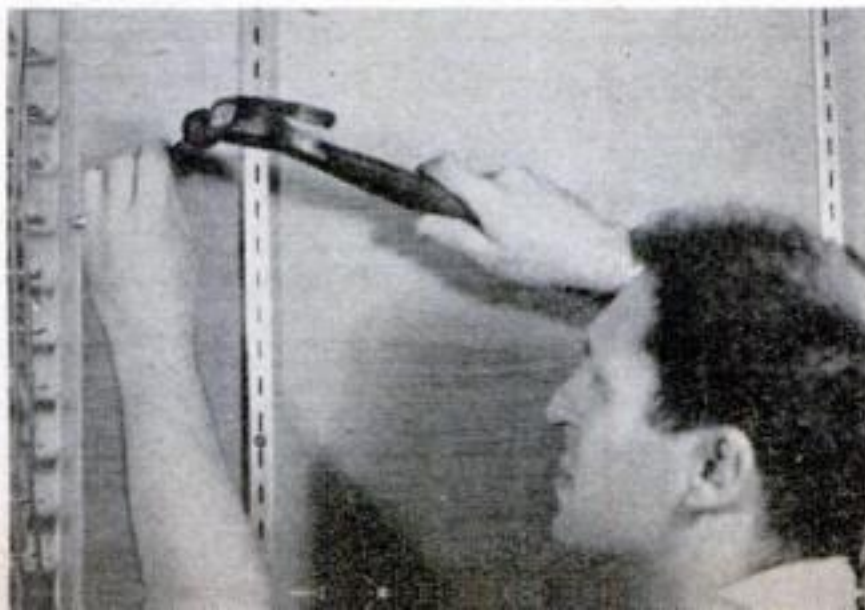
If the wall is plasterboard, screw the

slotted standards to a plywood panel ($\frac{1}{4}$ " or $\frac{3}{8}$ " will do) and then nail the panel to the studs. In the case of a lath and plaster wall, the standards may be fastened directly to it with toggle bolts. Measure the wall space carefully for the plywood panels. In old buildings, the window frames may have sagged out of square. Get exact dimensions so the panels will fit neatly into the space you have.—W. I. Fischman, Philadelphia, Pa.



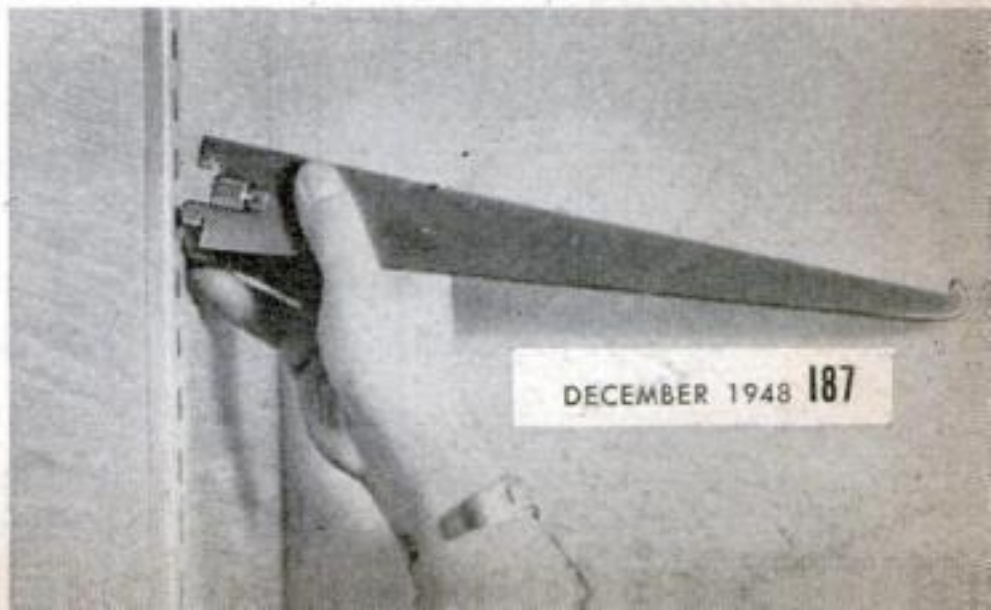
Exact measurement is essential if the plywood panels are to evenly fill the space between the walls at each side and the window edges.

After screwing standards to plywood, nail the panels to wall studs. On plaster walls, toggle bolts may be used directly, skipping the panels.



Knife standards, here being screwed to plywood, come in stock lengths. Panels should be a little longer than these slotted strips.

Knife brackets fit into slots and are tightened into position by knurled knobs. You can get them in various sizes, but 8" is good for books.



What's Your Ingenuity Quotient?

5011

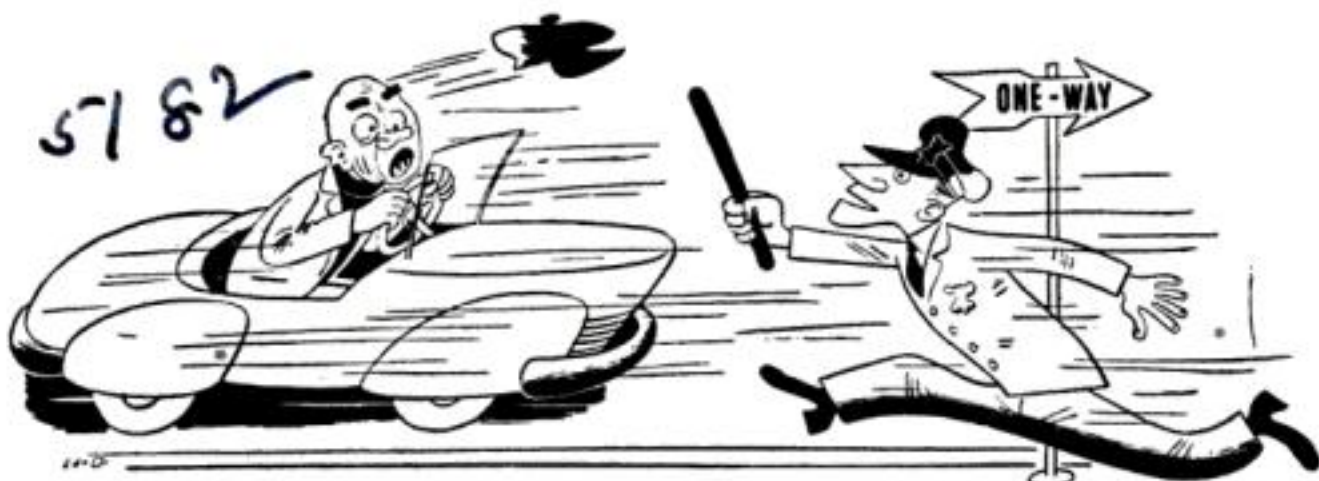
Winter built a window for me one bitterly cold Sunday when a pane of glass was broken. We couldn't get a glazier that day and I couldn't find anything to tack over the break. I hooked the shower hose to the sink faucet and sprayed little bursts of



water over the jagged hole. In 15 minutes this built up to a solid sheet, closing the opening.—*Ronald Fritz, Brooklyn, N. Y.*

My psychology teacher said

that most criminals are backward. Any thief who would steal my car would have to be extra backward—so backward, in fact, that he'd make his getaway backwards. When the ignition lock broke, I fitted a ringbolt in the dashboard. When I leave my car, I put it in



reverse and padlock the gearshift lever to the dash.—*C. A. Henzel, Bainbridge, Md.*

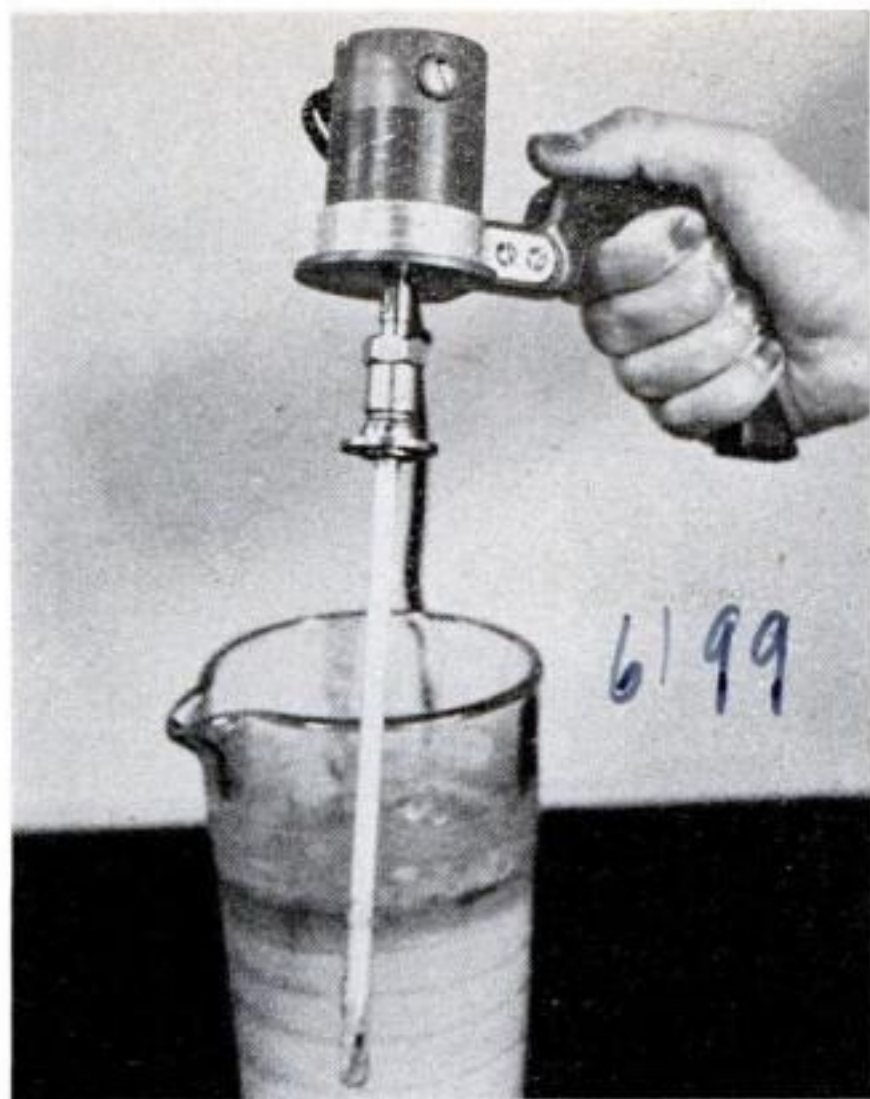


All winter long my feet used to get chilblains because our floors were cold enough for penguins, while the heat sulked at the ceiling instead of doing me any good. Mounting an oscillating fan near the ceiling helped out, but the fan motor overheated in constant operation. The remedy: I connected it in parallel with the refrigerator motor, so that it ran only when the refrigerator did. No overheating now, and the floor is warm.—*Joe Biesek, Chicago.*



If you see red when the sink trap clogs, try an infrared heat lamp. This gimmick works if the stoppage is due mostly to greasy waste. After that any of the commercial drain cleaners will finish the job for you.—*Ansel Cooke, Seattle, Wash.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

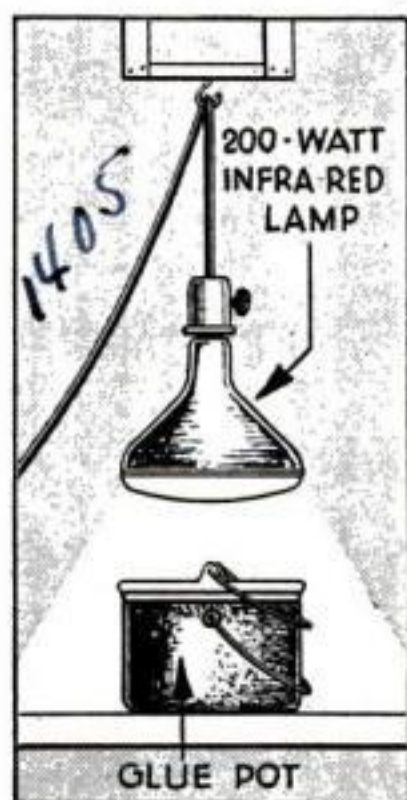


Surplus Motor Makes Mixer

THE three main parts of this homemade mixer are a wound-field, surplus aircraft motor with the armature and field windings connected in series, a coffee-maker handle, and a 6" radio extension shaft. I put them together in an evening, added a 6' cord, and the mixer was ready to use.

One end of the shaft was hammered flat. The other end was pushed into the motor coupling and soldered in place. The flattened end does a fast, professional mixing job with no splashing. If you don't have an old coffee-maker handle around, cut one out of $\frac{3}{4}$ " stock.—Wil Fulker, Monument, Colo.

Infrared Lamp Keeps Glue Hot

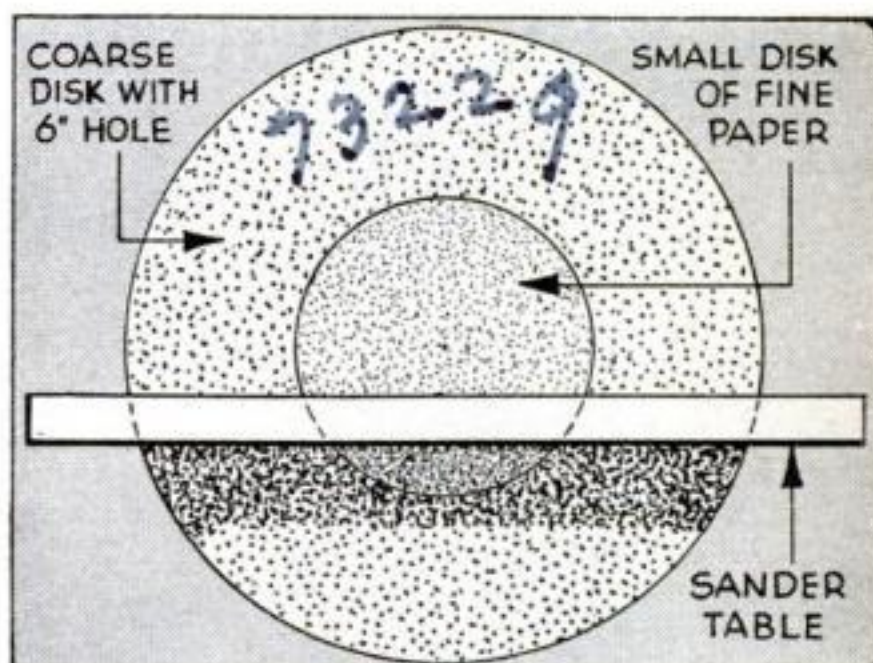


GLUE can be cooked without burning and kept warm while it is being used by suspending a 200-watt infrared lamp over the pot. The same lamp will increase the working capacity of an electric soldering iron. It preheats the work and the solder will run freely.—F. G. Harrington, Leaside Toronto, Ont.



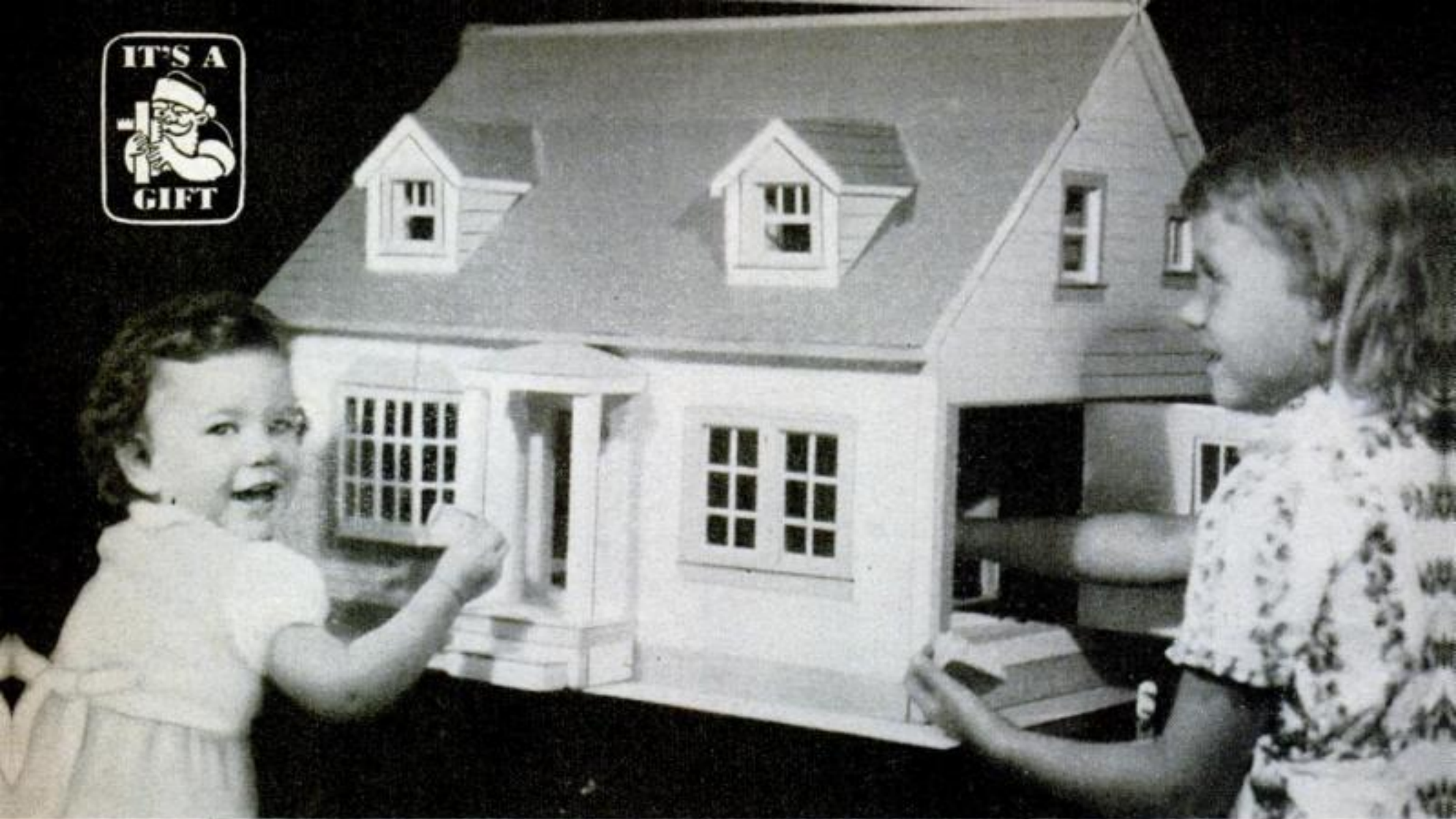
Smoothing a Lacquer Surface

IRREGULARITIES in a lacquer surface, including deep sag marks, can be removed with a razor blade in a suitable holder. Draw the blade across the surface, holding it at about the angle shown. Continue scraping until the surface is even but try to avoid cutting down to the base coat. Next rub the surface lightly with fine steel wool. Then apply a coat of lacquer thinly sprayed. When dry, sand this coat lightly with a fine abrasive paper and finish it with a rubbing compound.—Walter E. Burton, Akron, Ohio.



Two-Way Disk Speeds Sanding

You can do fast sanding and yet end up with a smooth finish on your work by cutting and mounting a disk of fine sandpaper inside a coarse disk as shown in the drawing. Use medium fine paper for the inner disk. Do the heavy sanding on the coarse part and then move inside for the finishing. I've found that the trick works equally well with an emery disk combined with fine emery paper.—Herbert Pfister, Bronx, N. Y.



You'll be voted the Santa Claus most likely to succeed for building this dream doll house.

6308

By Henry Clark

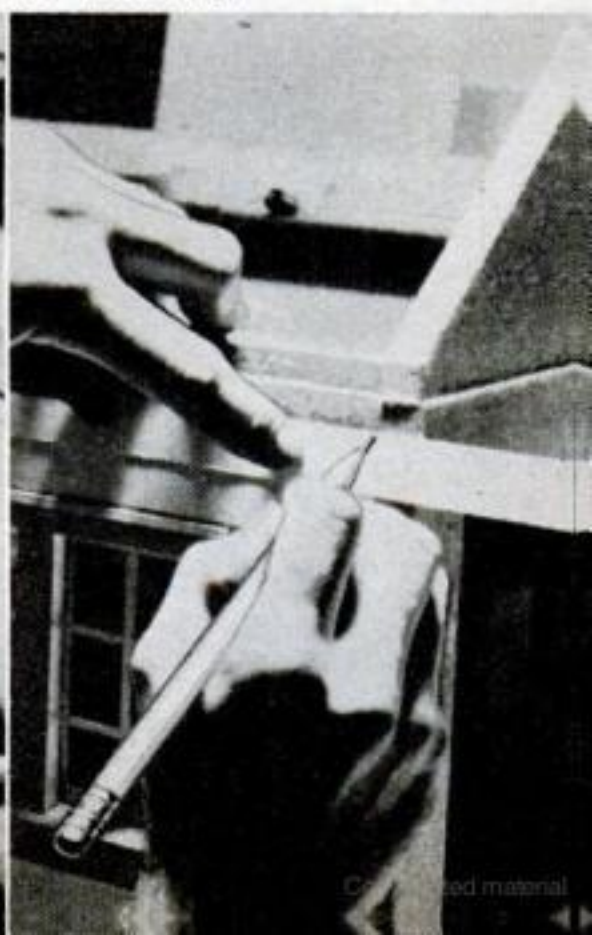
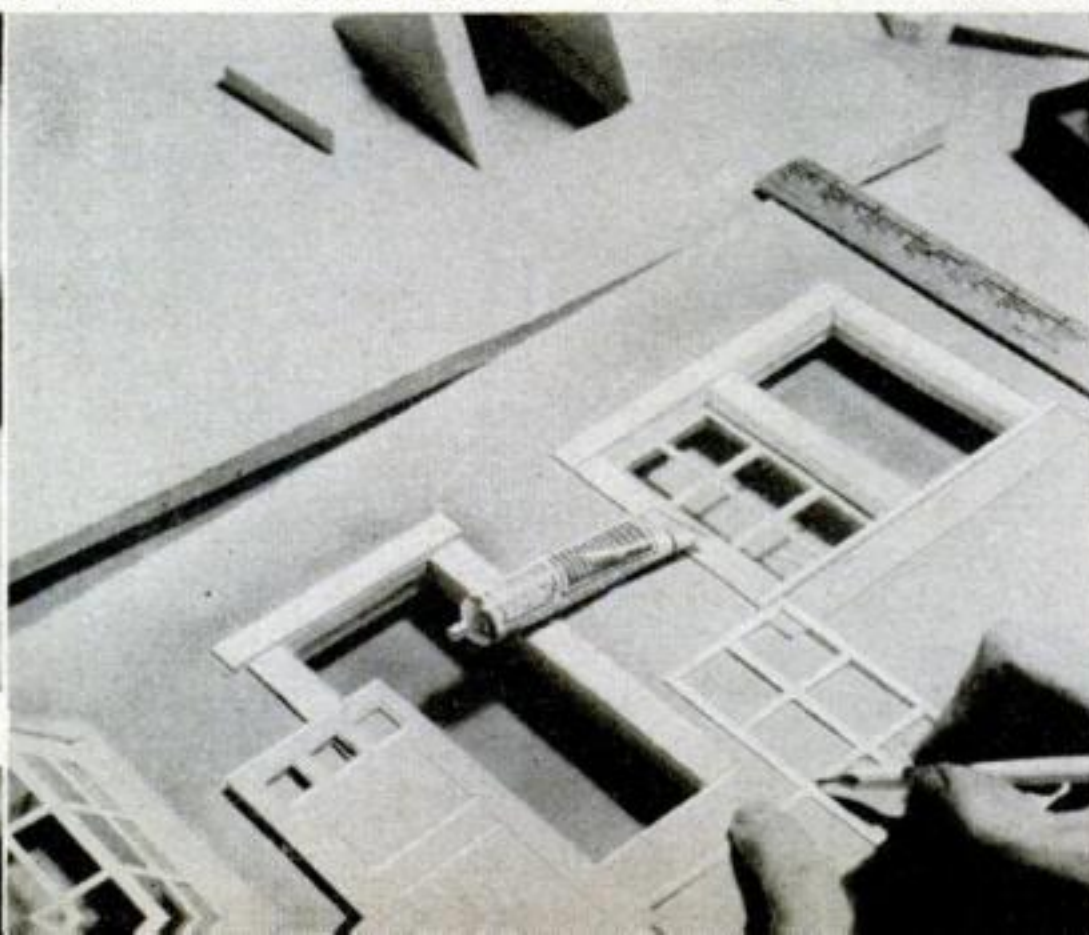
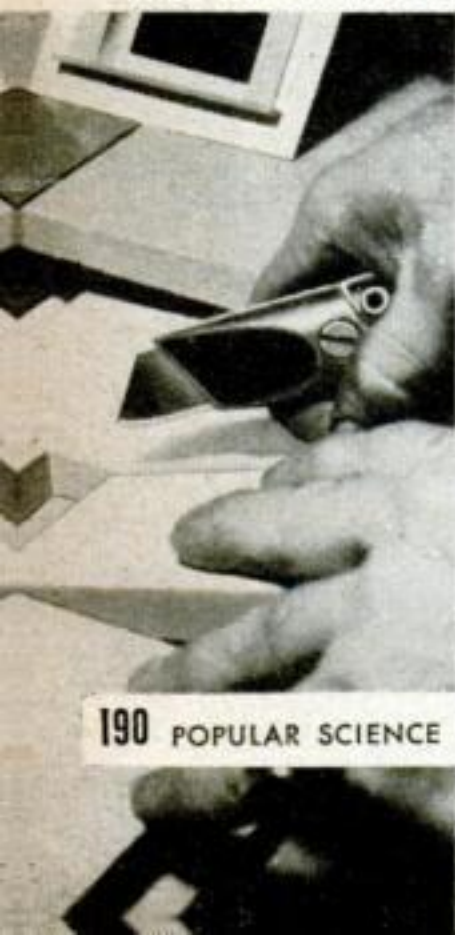
Wallboard Ends Doll Housing Shortage

THIS is a low-cost housing project that you can lay out and put together with a minimum of tools. In fact, the parts of the bungalow pictured here were cut out with only two simple tools—a mat knife and scissors.

The basic material is a 4' by 8' sheet of $\frac{1}{2}$ " wallboard. This forms the walls, floors, and roof. The white clapboard siding is $\frac{1}{16}$ " showcard stock cut into $\frac{3}{8}$ " strips. Window frames, stairs, and trim are $\frac{1}{8}$ "

The knife is the principal tool. It easily cuts this type of wallboard, as the doorway at lower left. Before final assembly of the walls, measure, cut, and cement the window frames and doors.

These details, center, are much simpler to fit when the walls are lying flat. For a perfect job, put on the clapboard siding last, carefully working up to and around all windows.



showcard, while coarse sandpaper, thinly tinted with enamel, simulates the asphalt roofing.

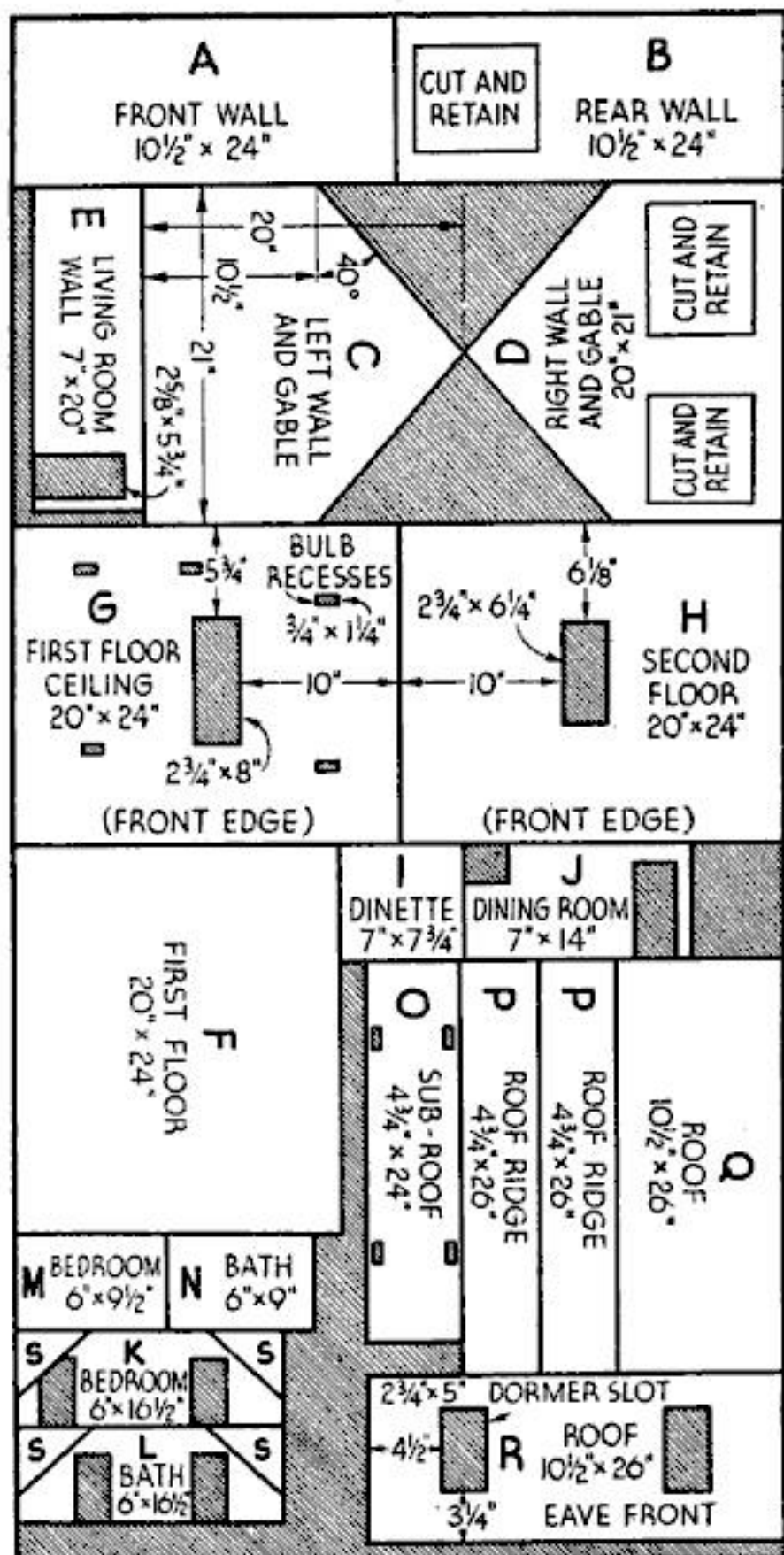
Buy a wallboard that you can cut with the knife. Such board is a tightly packed pulp, painted flat white on one side and loosely fibered on the other. Face the painted side indoors on the house. The other surface will be covered by the siding.

When laid off and cut out as shown in the plan at right, the 4' by 8' sheet will give you all the parts of the house—minus the trim, roofing, siding, and stairs. The next step is to slice out the doors and windows. Save all wallboard scraps from the cutting operations. You'll need them for the chimney, the dormer windows, the front porch, and other details.

Now you're ready to start building. Cement foundation cleats inside the bottom of the walls to support the first floor. Erect the four walls and insert the first floor. Then tie a cord around the walls to hold them together temporarily. Cement in the three first-floor partitions. On these, place the ceiling with the opening over the stair position. The stairs are assembled outside the house and fitted in later.

Separator cleats now are glued to the top of the ceiling. These support the second floor and provide space between the two for wiring. Do not cement the second floor at this point. You may want to remove it later for wiring. However, fit the four second-floor partitions, cementing as you go. Then glue the sub-roof in place.

You can wire the lights in parallel, using a heavy-duty bell transformer or a toy train transformer. An alternative is Christmas tree

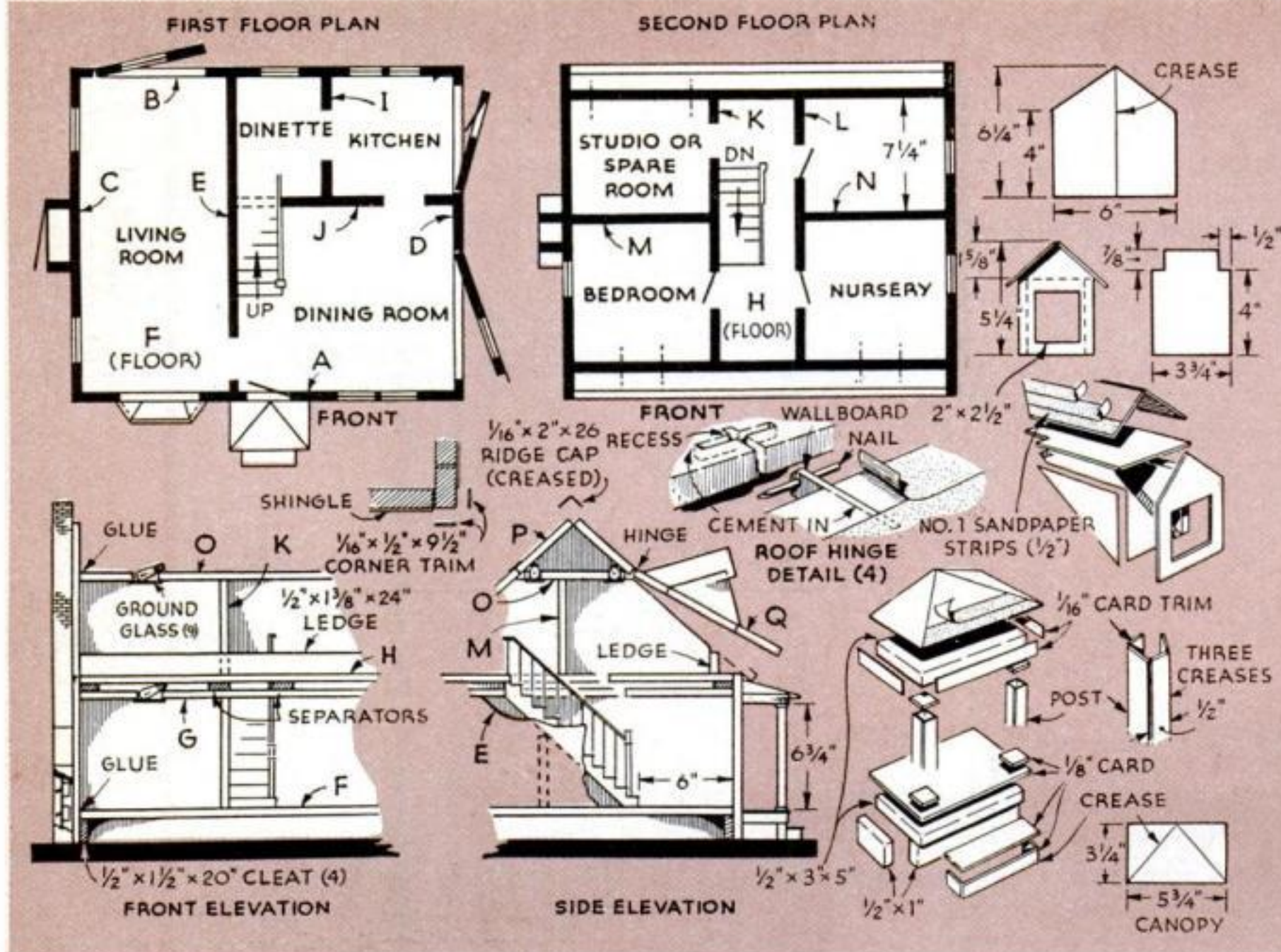


All major parts are cut from one 4' by 8' slab of wallboard. Letters of the above sections correspond to those in top drawing on page 193.

Fully assemble the stairway before placing it inside the house, lower left. Build the frame first and then work down from the top, fitting steps and risers. The newel is 3 1/2" high, made

of a 1 1/4" piece of cardboard creased and folded. At lower right is a rear view of the house as it neared final assembly. Both floors have been wired and the stairway cemented in place.

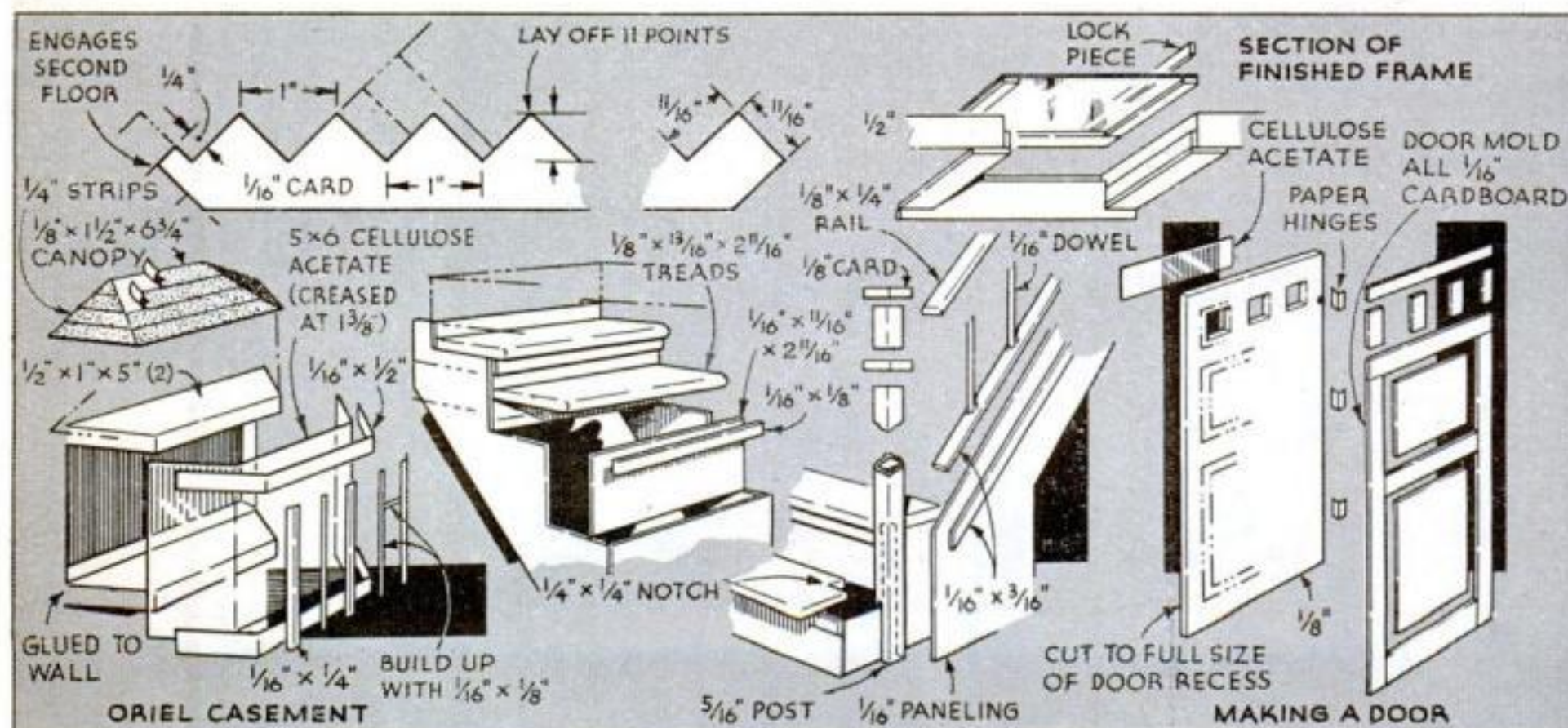


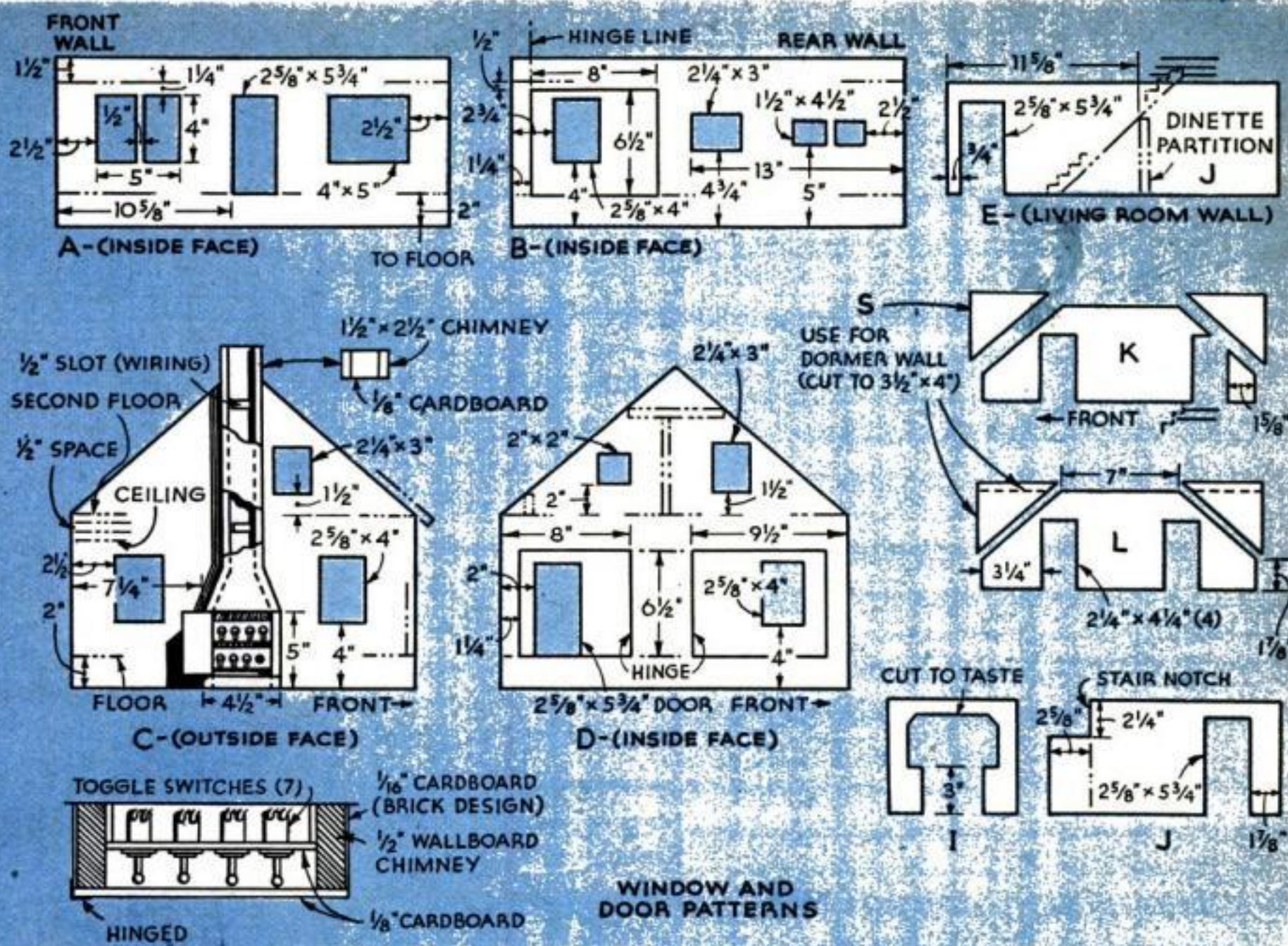


lights in series, but this doesn't permit the various lights to be turned on and off individually. Cement the light bulbs in the slots cut in the first-floor ceiling and in the sub-roof and trail the wires down the chimney. An extra touch is a piece of ground glass glued under each lamp recess to diffuse the light. Locate the switch panel

in the base of the chimney. There it is easily accessible and can be concealed by a hinged cover. In the house I built, seven toggle switches control nine lights.

Cut and fit the window frames and sashes and the clapboard before cementing the outer walls in place. They are easier to work with when lying flat. Cut the win-





dow details from $\frac{1}{8}$ " showcard and use clear acetate for the panes. Build up the dormers with the roof in place. Strips of $\frac{1}{16}$ " showcard, $\frac{3}{4}$ " wide, make the clapboard. Start from the foundation line and work up, lapping on the strips.

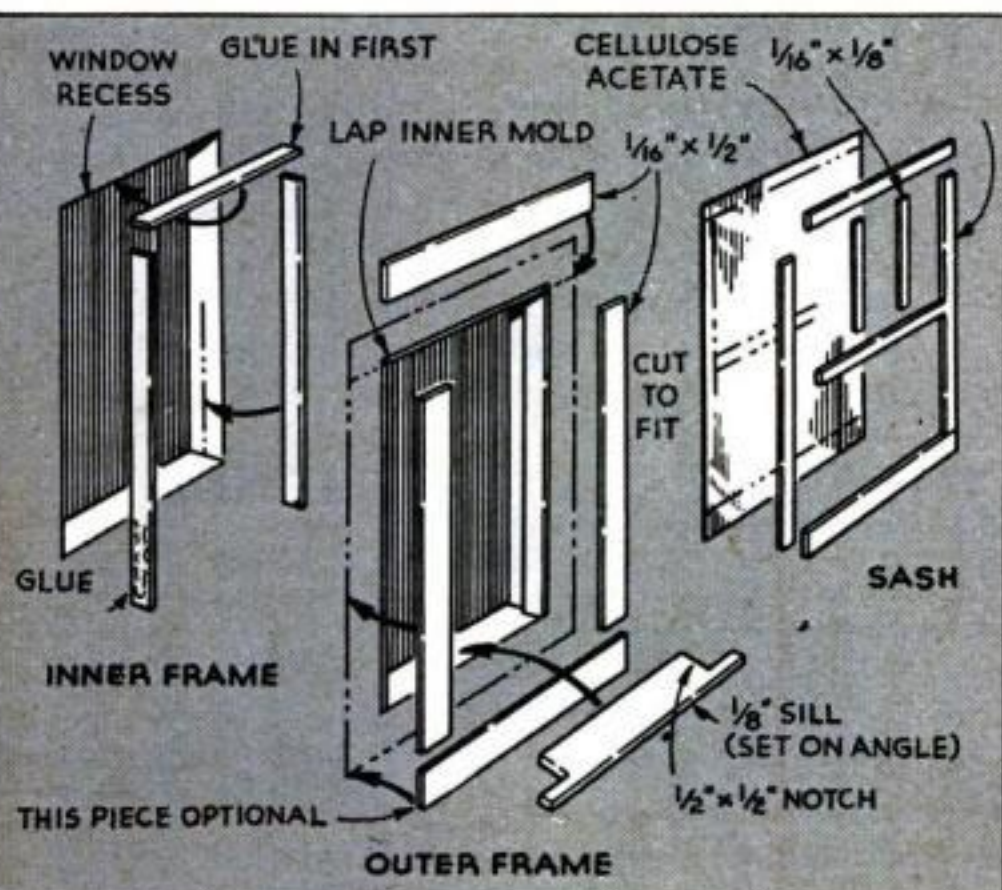
Hinge the two roof sections to the roof ridge pieces and then cement the ridges to

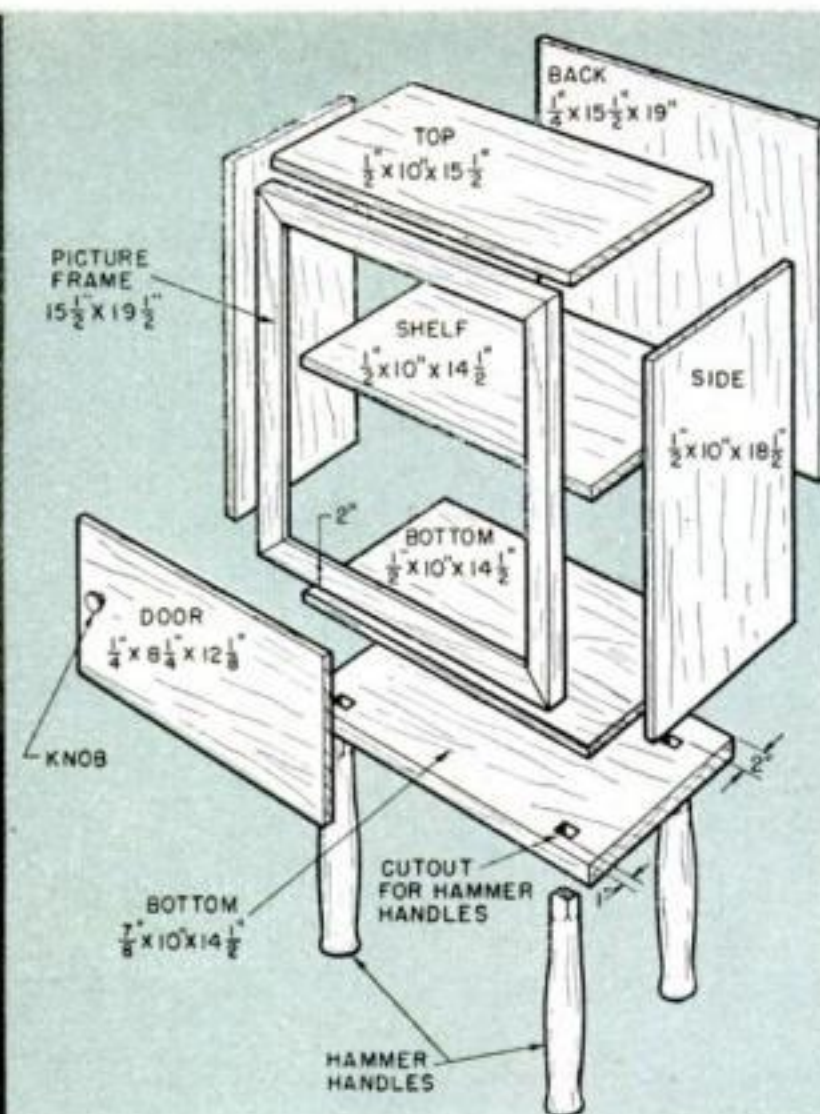
the peaks of the sidewalls. In the drawing at the top of the opposite page, the hinge details for the roof are shown. Hinge the three wall sections—indicated in the above drawing—with adhesive tape. Strip the tape down the hinge slits and cement clapboard over it. Butt the clapboard at these hinges, leaving a $\frac{1}{16}$ " gap for swing action.

Construct the chimney from $\frac{1}{2}$ " strips of wallboard and $\frac{1}{8}$ " showcard. You can cement the chimney over the clapboard, or you can install the chimney first and fit the clapboard around it. Cover the chimney with thin red cardboard or paper on which you have ruled white mortar lines.

I selected $\frac{1}{2}$ " wallboard because of its scale to a real wall. The entire bungalow was built to accommodate a line of plastic, scale-model furniture that is widely marketed. As an interior finish, I went along with the already painted side of the wallboard. Any other color scheme is up to you. Extras, such as cupboards or shelves, can be added later by working through the hinged wall and roof sections. The exterior finish is taken care of by the white clapboard.

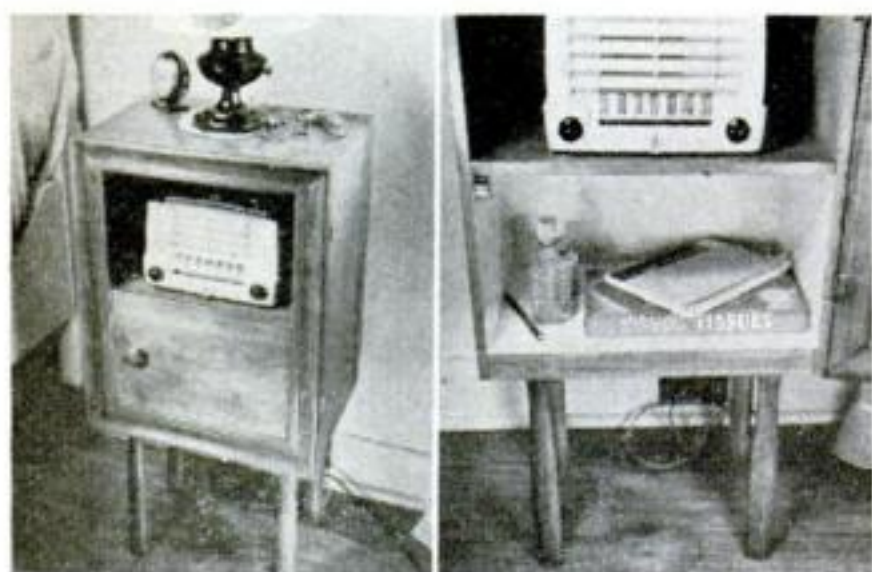
END





Four hammer handles and a picture frame give you a good start on this bedroom piece.

Bedside Table Has Picture-Frame Door 6 192



Picture frame is hinged to serve as a door. A panel of $\frac{1}{4}$ " plywood across the lower half closes the bottom compartment of the case. The finished table stands about 30" high.



WHILE shopping one day in a hardware store, I came across a stock of hammer handles. Why not, I thought, use them as legs for the bedside table my wife had been wanting?

The case itself could be a butt-joint job, but I wanted some ornamentation to relieve that shoebox look. I had no way to make molded edges or a paneled door. The an-



Notch each handle at the top by making a saw cut and chiseling out the waste as seen here.



Set each leg in a hole bored and chiseled in table bottom. Fill cracks with glue and sawdust.

swer was a picture frame—molding ready-made into a door. I bought one; you may find yours in the attic.

With the handles and frame in hand, the job became mostly a matter of sawing a few straight lines. First the handles and a 10" by 14½" piece of ¾" stock were assembled into a sort of stool. The legs were fitted by boring and chiseling suitable holes. A glue-sawdust mixture tamped into the spaces around the legs and allowed to dry gave me a solid construction.

After sawing the parts of the case, I made

a trial assembly, using short strips of cloth tape at the corners. Satisfied that all pieces were a good fit, I tacked the case together with 1¼" brads, countersinking and filling in the heads with plastic composition wood. Finally, the case was tacked to the stool and the picture frame attached with hinges.

Maple stain followed thorough sanding. Spar varnish came next. When this was dry, the gloss was cut with steel wool and the surface waxed. The inside of the lower section was painted yellow.—*Arthur C. Miller, Manhattan, N. Y.*

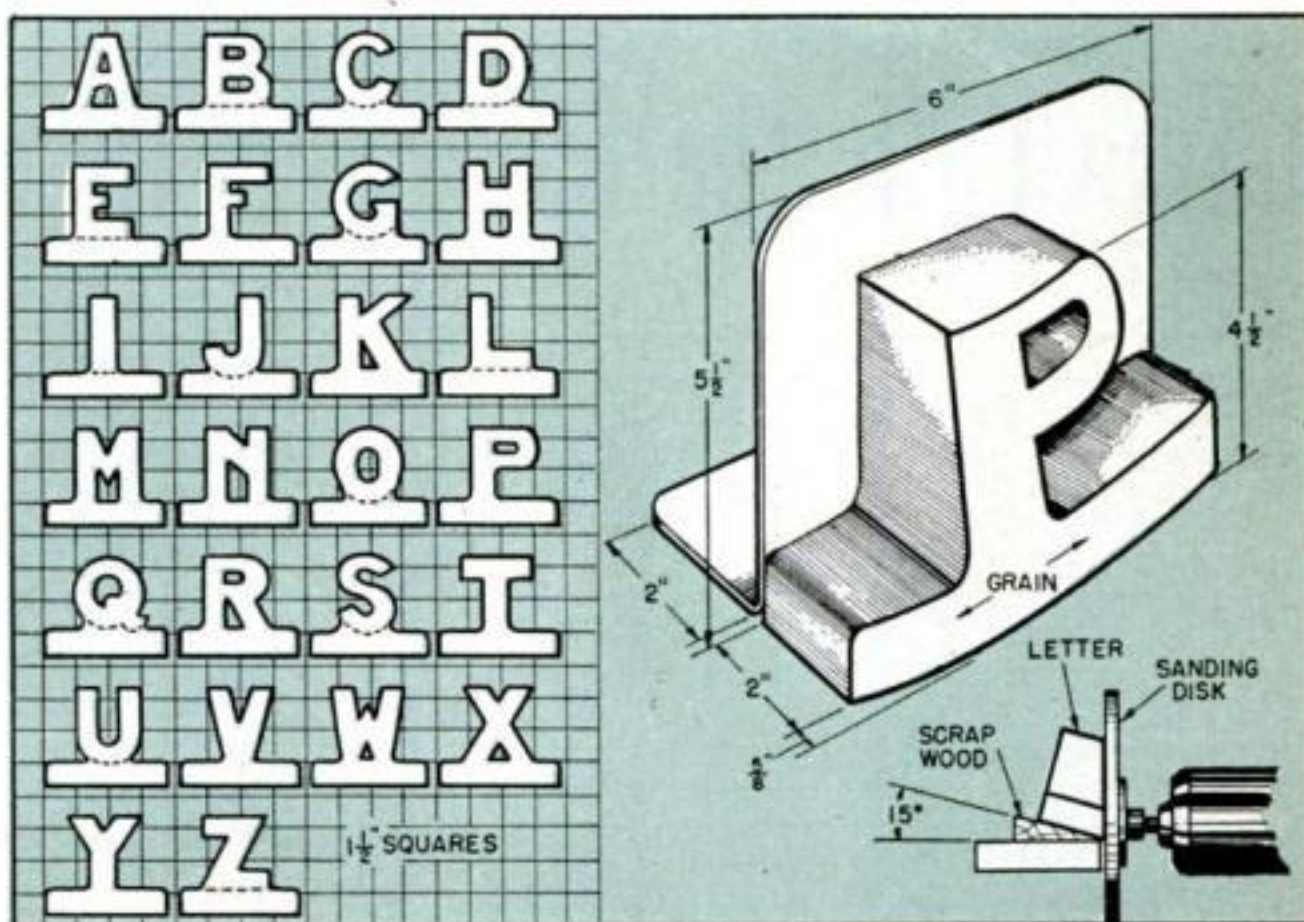
Initials Form ⁶²²² Massive Book Ends

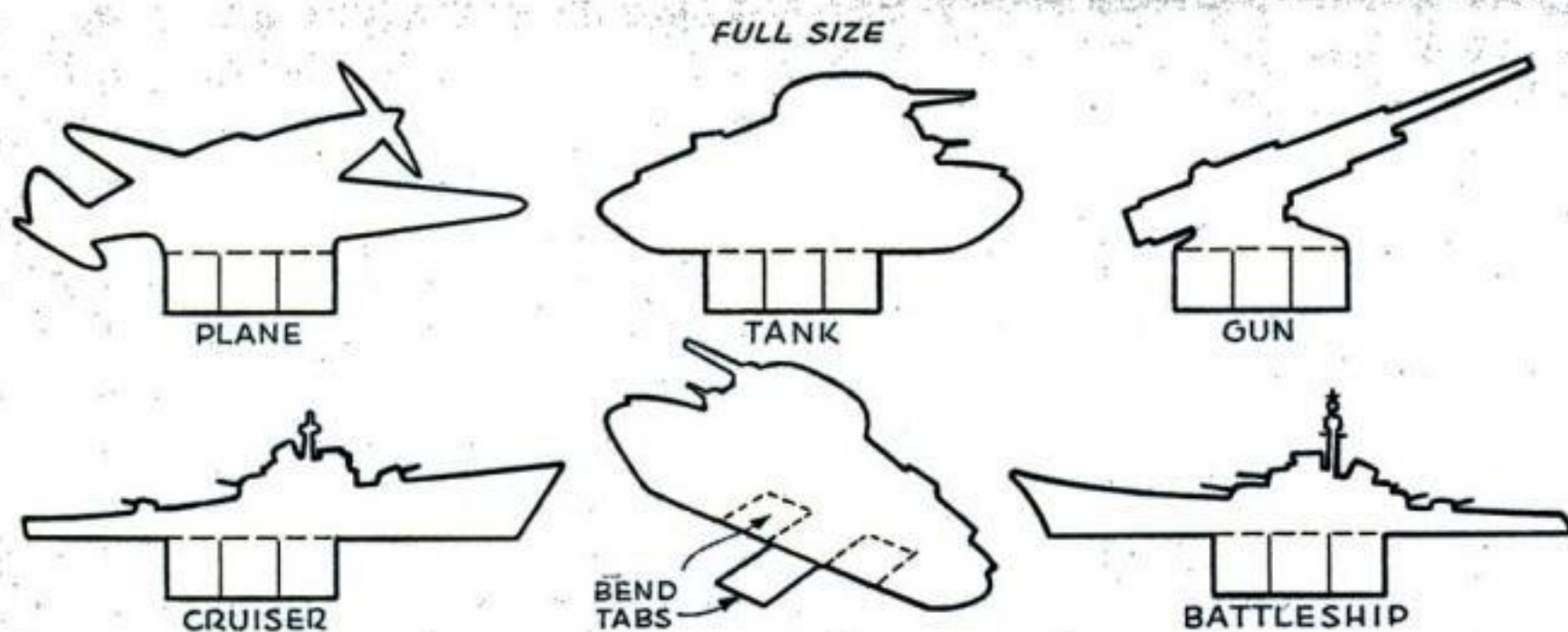
THE impressive appearance of these book ends is far out of proportion to their simple construction.

Begin by making the back plate from 1/32" brass, aluminum, copper, or other sheet metal. Cut each piece 6" by 7½" and bend back 2" of the longer dimension to slip under the books. Round off the corners, buff bright, and apply clear lacquer or wax.

All initials are made in the same way. Center the layout of the letter on a block of any decorative wood that's been cut so it measures about 6" along the grain, 4½" across the grain, and between 2½" and 3" thick. Saw to shape and bore and file out any inside openings.

If your sanding-disk table doesn't tilt, tack the letter to a block of scrap cut to a 15-deg. angle. Roll the face of the letter against the disk. This gives it a curved face and the appearance of leaning back. If you wish, a groove cut across the bottom of the letter (dotted in the alphabet shown) will set it off from the base. Countersunk flathead screws hold on the back plate.—*Herbert Pfister, Bronx, N. Y.*





Game Calls for Land-Sea-Air Strategy

2016

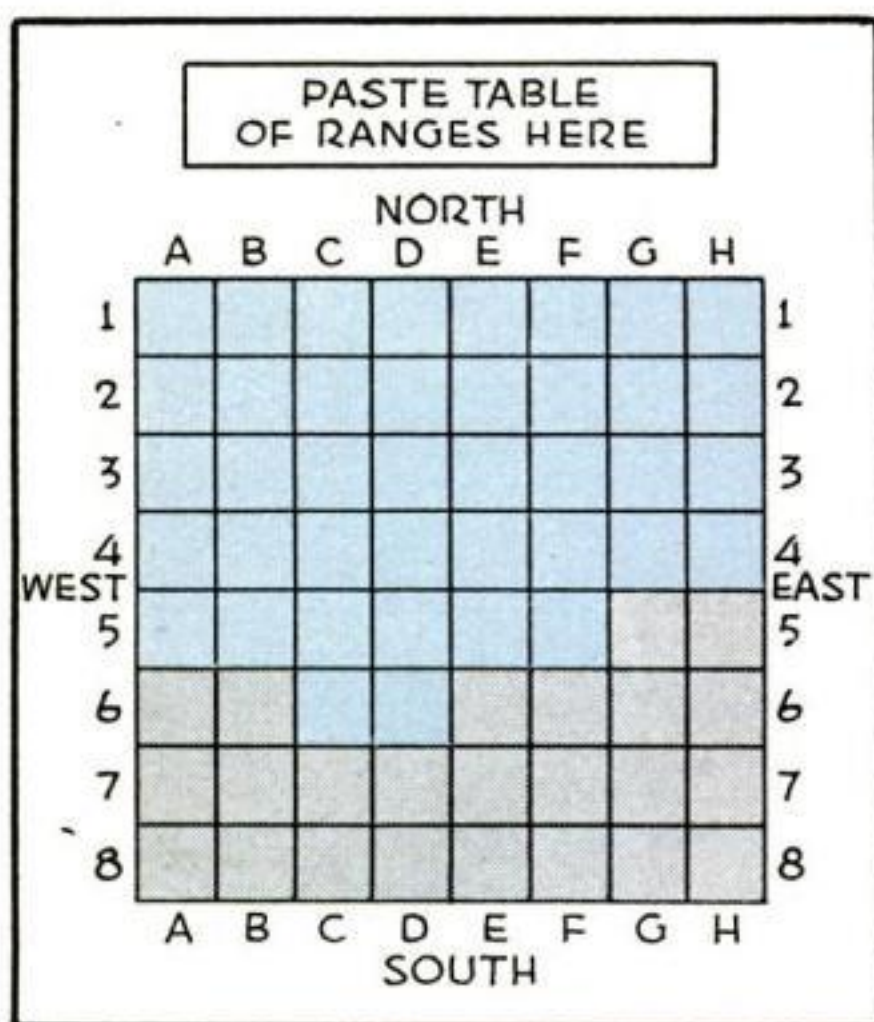


TABLE OF RANGES			
NO.	TYPE OF PIECE	MOVE	SHOOT
2	COAST GUNS	NONE	3
3	AIRPLANES	3	2
2	TANKS	1	1
2	CRUISERS	2	1
1	BATTLESHIP	1	3
NO PLAYER CAN MOVE TWO TURNS IN SUCCESSION			

CALLED "Armchair General," this game for two requires skill in deceiving your opponent as to where you are shooting from and the piece used. Likewise, you must figure out where his pieces are to make hits.

Two identical boards are needed. Lay these out as shown on 12½" by 16" plywood, using 1¼" squares. Paint the blue area on each board to represent the ocean, and the remainder brown for land. Cut the playing pieces from tin. Each set consists of two coast guns, two planes, two tanks, two cruisers, and one battleship. Paint one set yellow and the other red.

A player sits so as not to see his opponent's board. Each puts down all his pieces where he wishes, with the tanks and guns on land, the ships at sea, and the planes on either land or sea. Each piece occupies only one square.

Play begins when one contestant calls a shot. For instance, if your battleship is on 2-C, you may shoot at 5-F, 2-F, or 5-C. Suppose you say "I am shooting at 5-F from the northwest." Your opponent then must reply whether a hit was made, depending on whether he had a piece on 5-F. If there was a hit, he removes the piece from the board but doesn't tell its type.

On any turn, a player can choose to give a piece its allotted move rather than shoot. He simply says "I am moving" without naming the piece. As in shooting, you can move vertically, horizontally, or diagonally.

The game ends when a player loses all his pieces.—W. H. Fulker, Colorado Springs.

6233

Modern Desk Chair Is Economy Job

WITH a few dollars worth of materials, you can revamp an old chair into an up-to-date piece of furniture. The old-timer pictured in the inset at right cost \$1.50. The sponge rubber, plywood scraps, and artificial leather were less than \$5.

Cut off the back of the chair at a height that suits you, and remove the splat—the thin center piece. With the top rail gone you'll need to brace the back with two pieces of 1" stock. Then use $\frac{1}{4}$ " plywood to box in the old lines of the chair into something newer. Use both glue and screws.

Next cut a slab of $\frac{1}{2}$ " sponge rubber to cover the seat and the front of the chair—not the sides and back of the seat. Scissor out the rubber just large enough to cover only the front and top of the back. Rubber cement will hold the sponge rubber in place on the chair.

Start the covering at the underside of the front of the seat. Pull it up over the sponge rubber, notch it for the rear legs, and fasten it to the back of the seat. Fold the corners neatly. Use brass-headed upholstery nails to anchor the artificial leather.

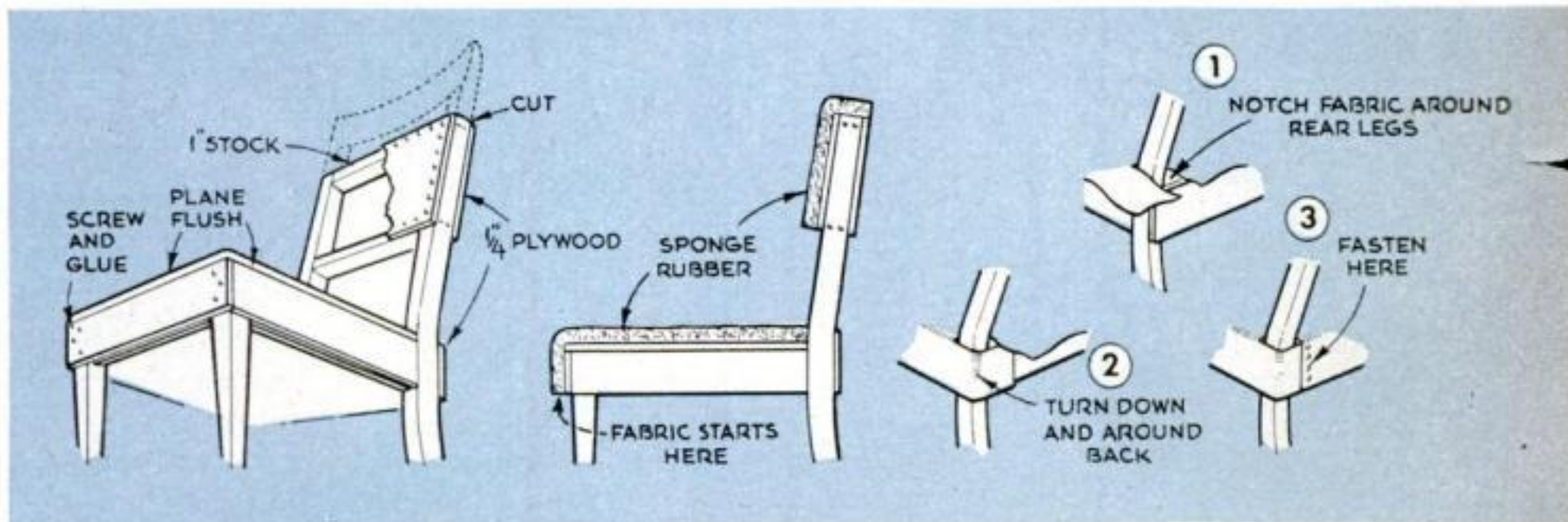
The chair I bought was varnished oak. For a light, limed-oak finish (which should be achieved before upholstering), I applied paint remover and then a coat of thinned white paint. This was wiped off after it had set a few minutes. Then several coats of thinned shellac were put on and rubbed with fine steel wool.—Robert Hoppough, Waukegan, Ill.

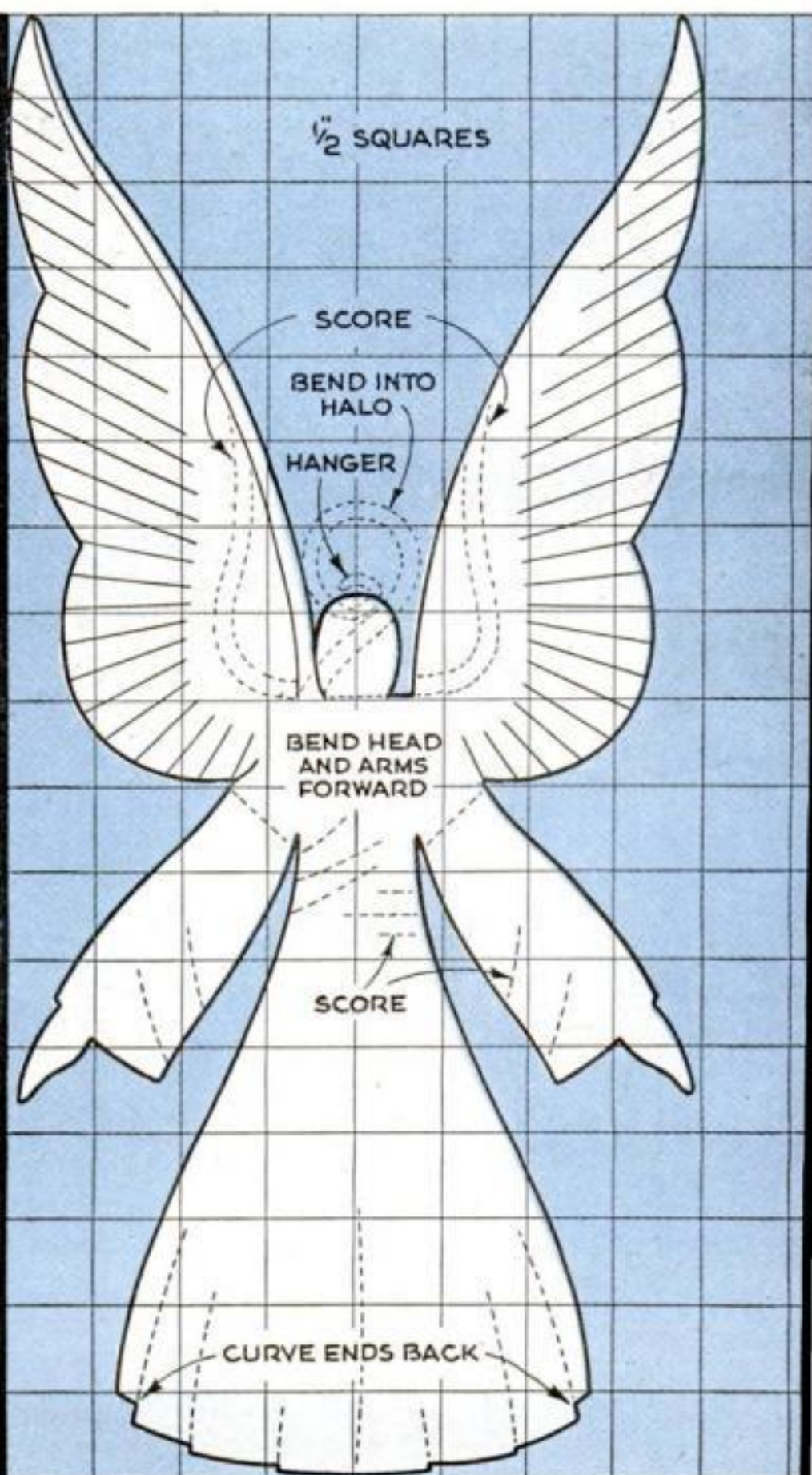
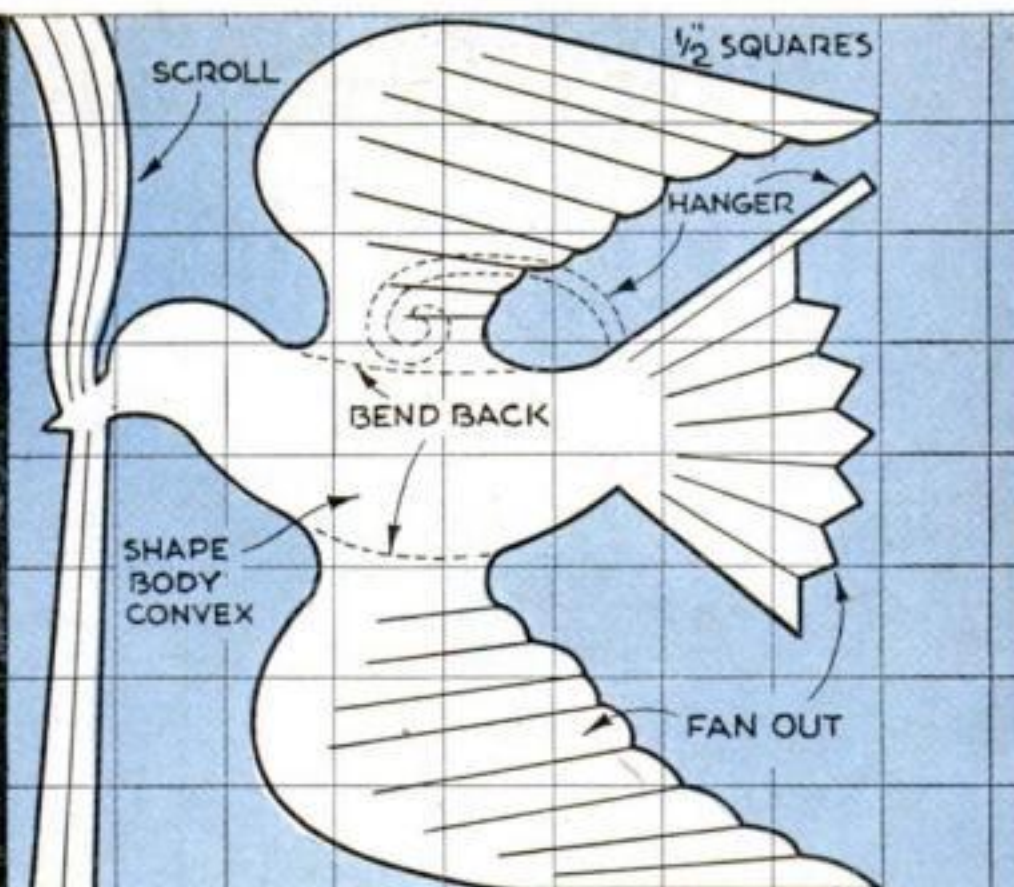


Something old, something new. The inset shows the original ugly duckling that was changed to a modern piece for less than \$5.



At left is the secondhand chair after the back has been cut down and the plywood boxing put on. **Right:** This is how the back covering is held with brass upholstery nails.





Cut Your Tree Ornaments from Tin Cans

By Harry Smith

6341

HANDICRAFT
FOR
CHRISTMAS

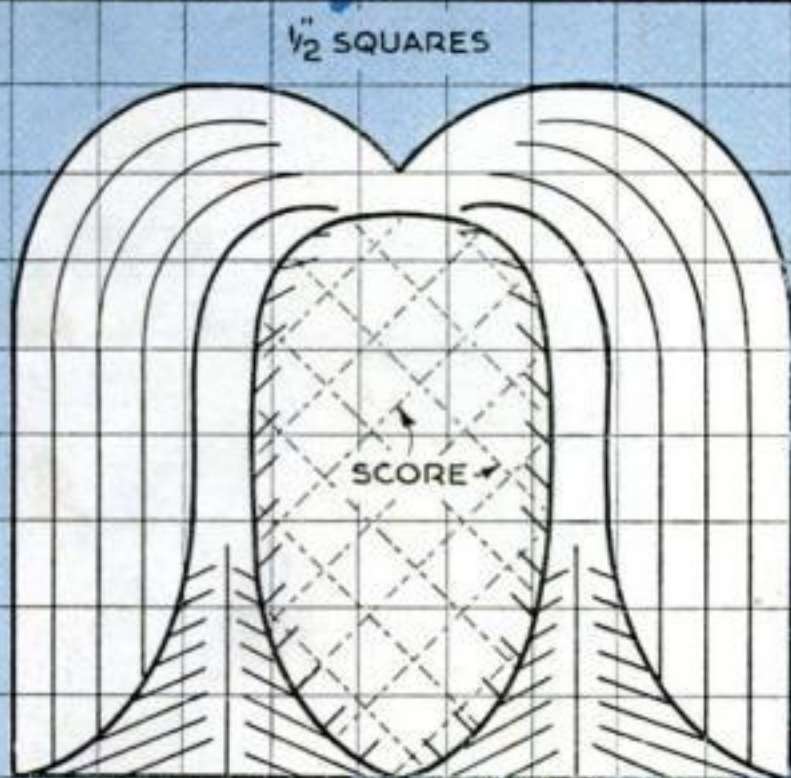


THESE glittering Christmas-tree ornaments are much simpler to make than they look. No soldering is required, and the only tools you need are a pair of ordinary tin snips for the rim cuts, and a pair of "duck-billed" snips for the patterns themselves. Common tin cans, which cut easily and curl naturally into graceful shapes, provide all the stock you'll want.

Pick a clean can, preferably with a gold

lining, and remove the bottom with a rotary opener. Inspect both rims for sharp projections, remove the label and glue dabs, and polish the metal to maximum brightness before cutting. Snip through the rims alongside the soldered seam, and (for all but the last two ornaments shown) cut off the rims close inside. Once these are off, the tin flattens readily.

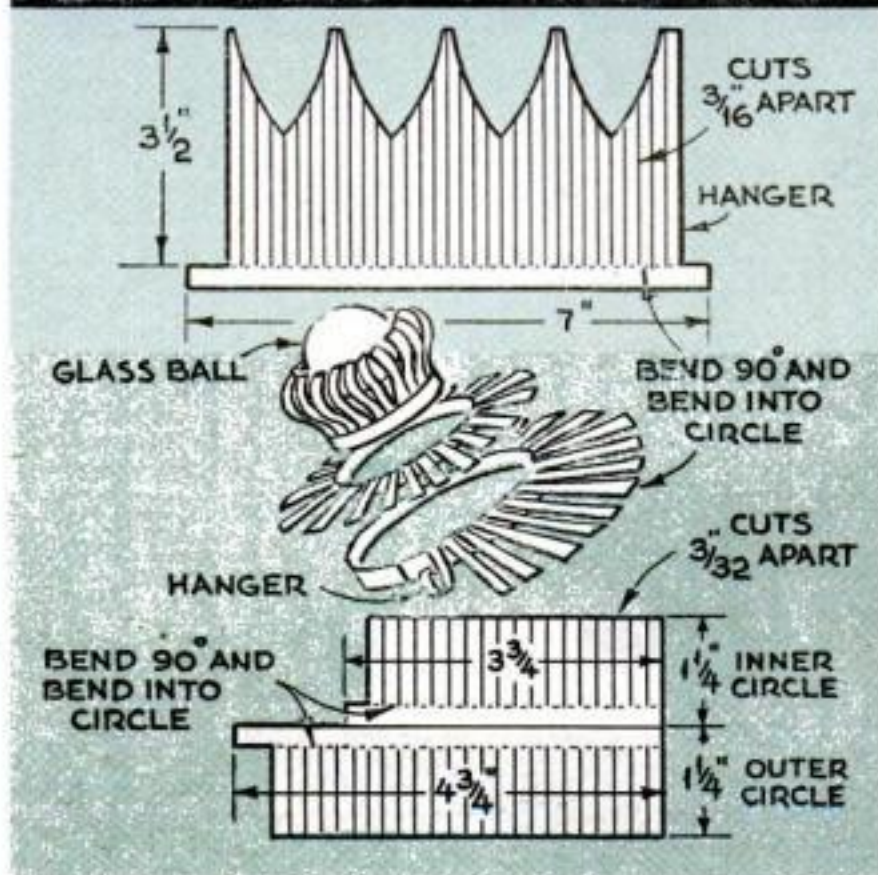
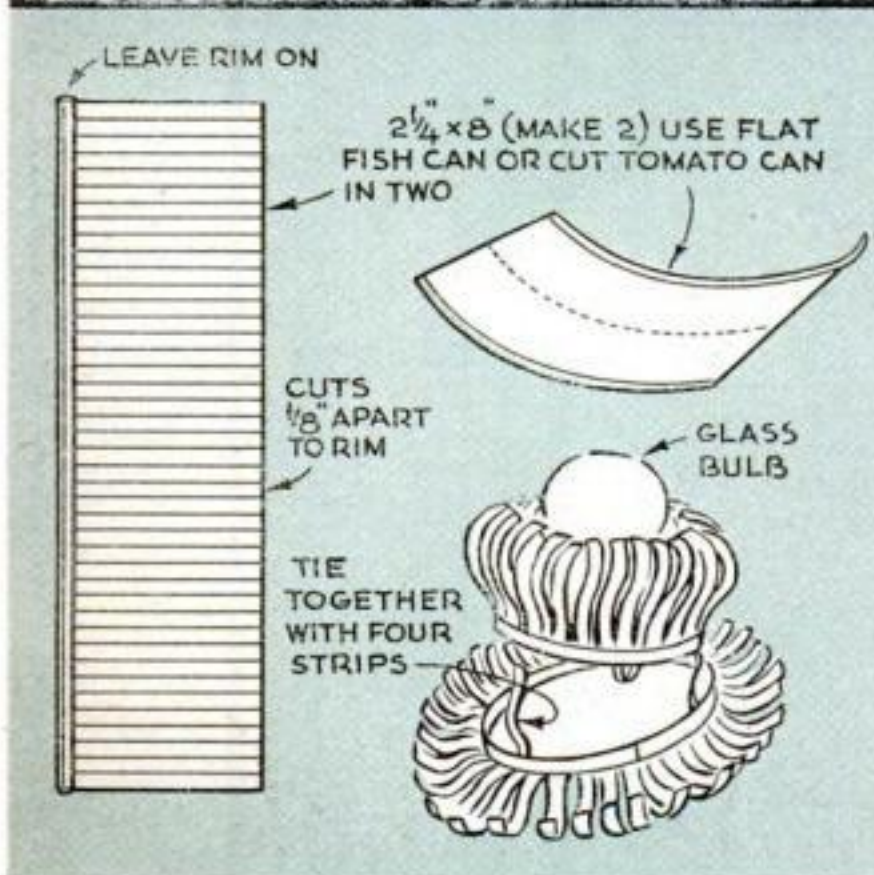
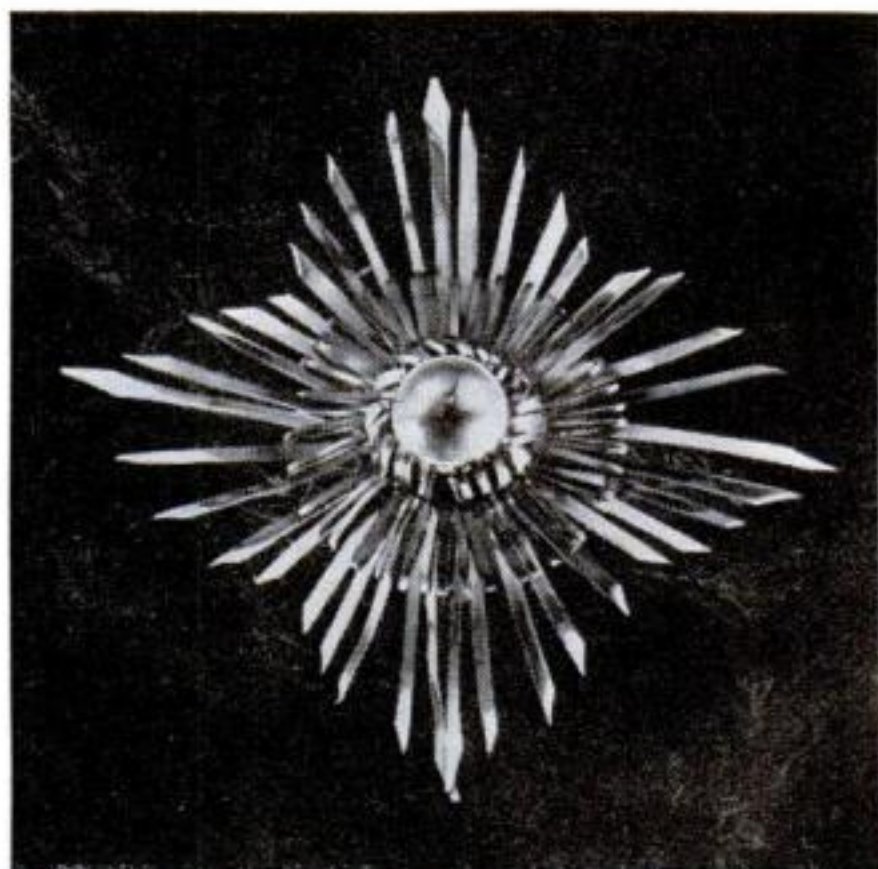
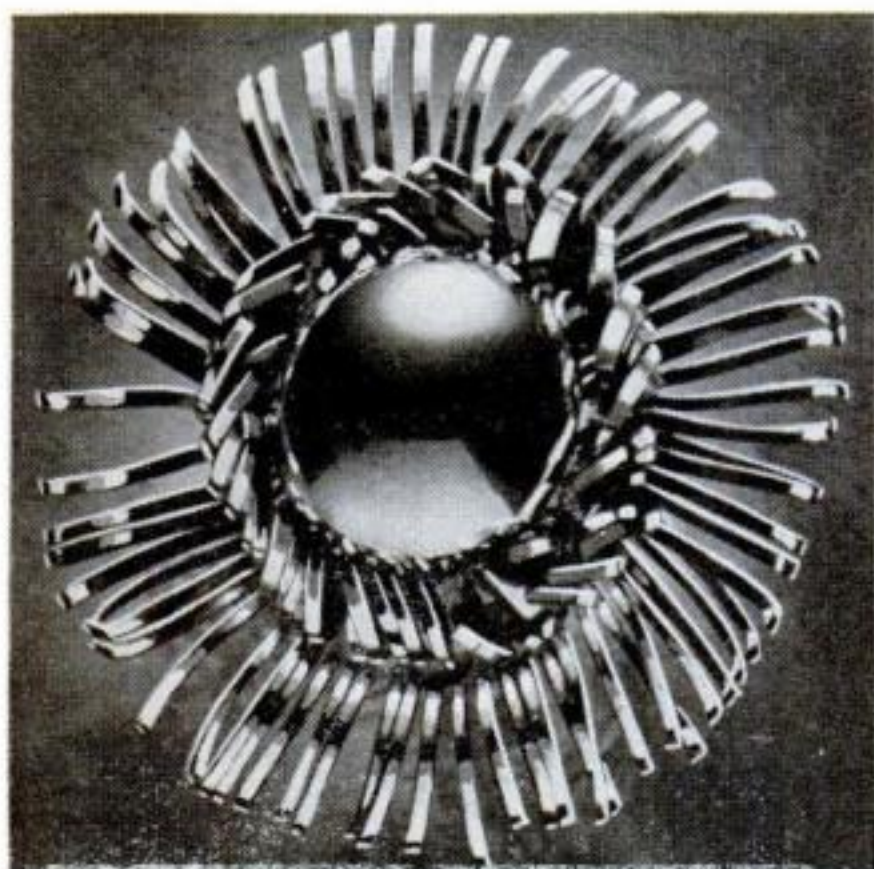
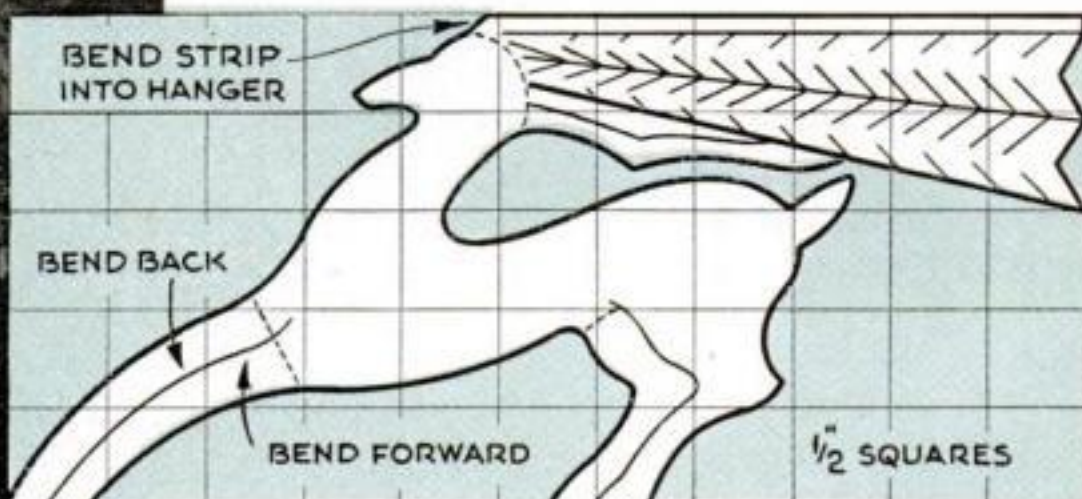
Enlarge the drawings to full size, tracing

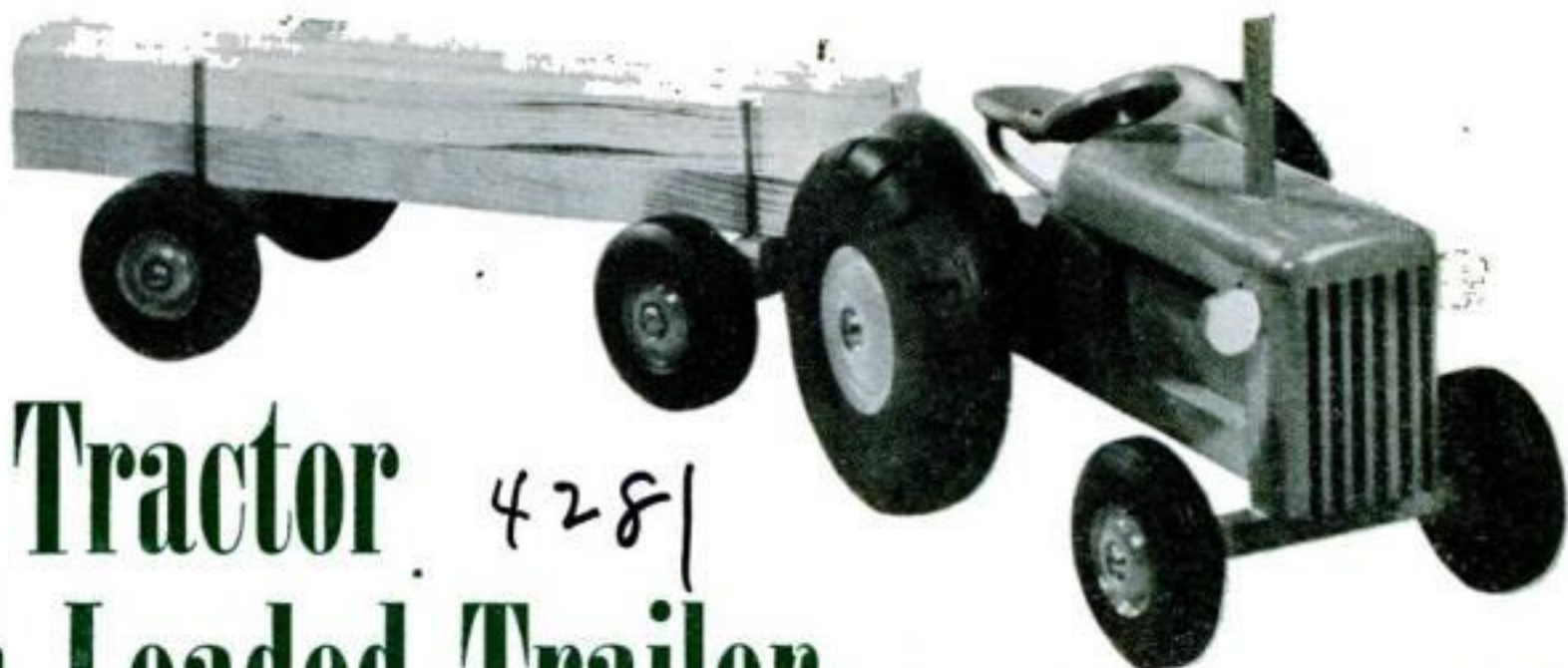




from point to point on squares, on strong paper. Trace them directly on the flattened metal, using carbon paper and a hard pencil. A blunt scribe or nail will make the scored lines. Handling the edges gingerly, bend to shape and attach a wire hanger. Silvery or bright-colored ball ornaments add an extra touch of glitter to the sunburst patterns.

END





Toy Tractor with Loaded Trailer

4281

Pieces from the scrap box made this realistic looking tractor-trailer.

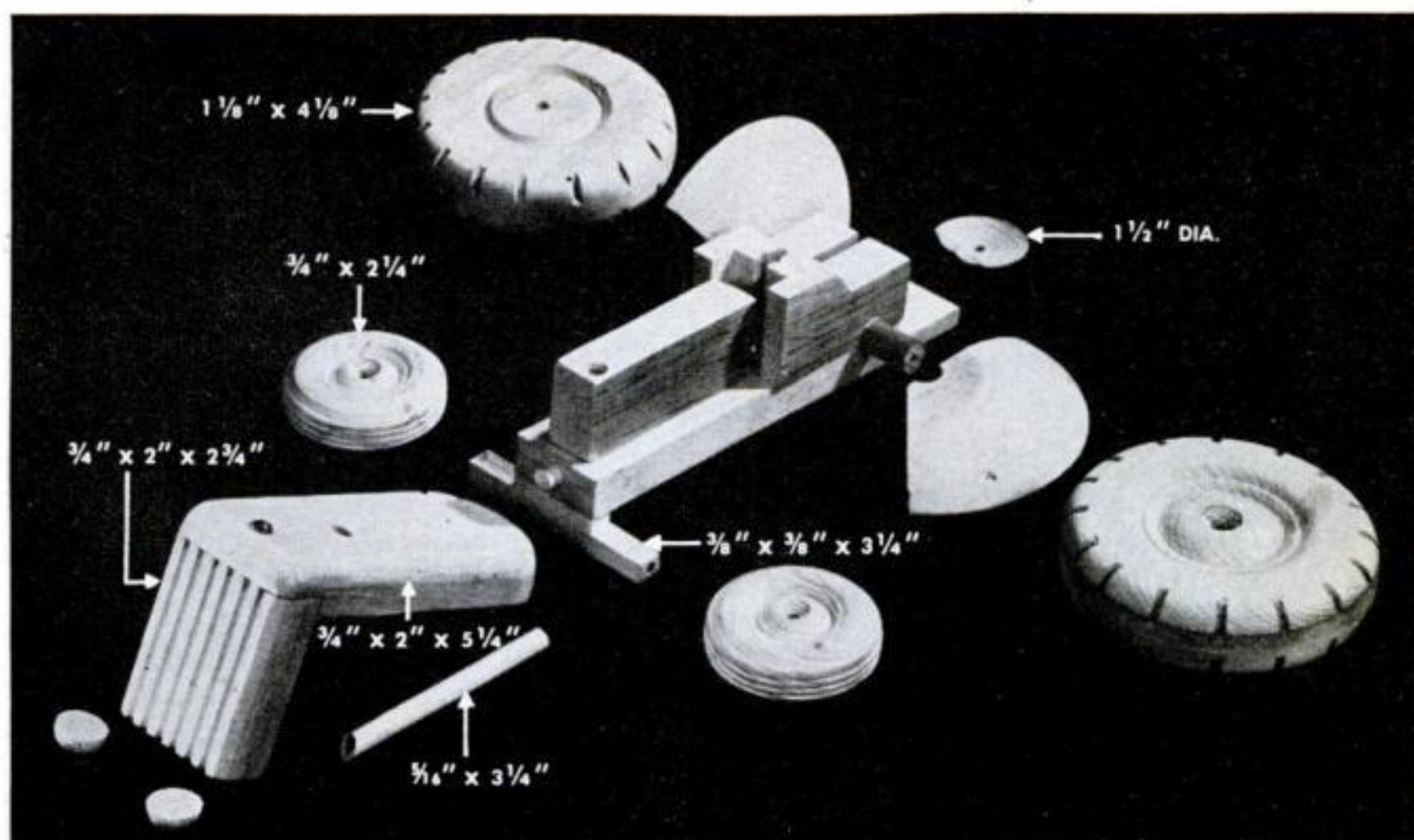
INDOORS or out, a youngster will have as much fun pulling this toy around as you'll have building it. None of the dimensions is critical since this isn't a scale model, but those given in the photos on this page and the next will help you in turning out a realistic plaything.

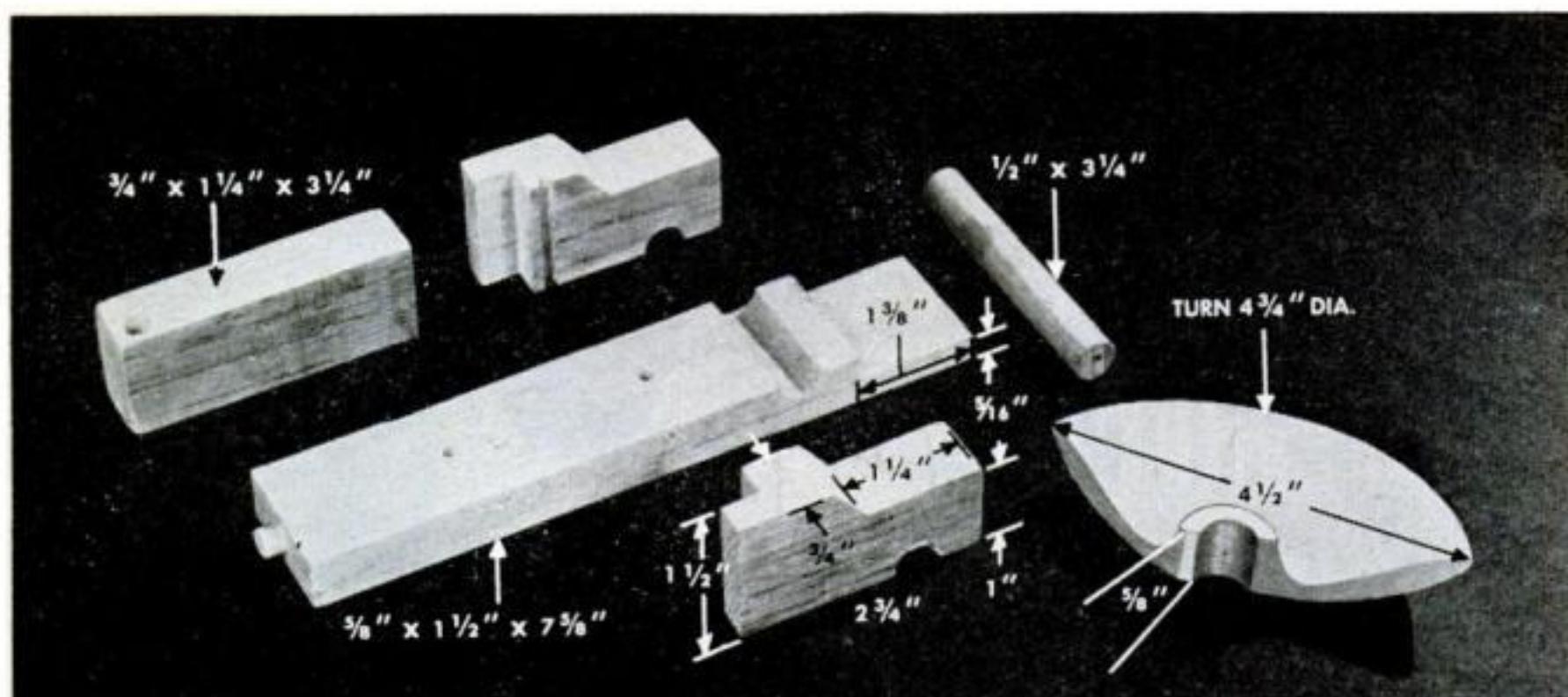
Almost any wood will do, but hardwood is preferable if the toy is to see lots of outdoor use. The model pictured here was built of scraps I had around the shop. Begin by constructing the engine hood and radiator, grooving the latter with a single dado saw. The roundhead screw that holds these parts together simulates the radiator cap. Next cut out the base, differential housing, and engine block. Sand all parts and assemble.

Before mounting the axles, drill holes $\frac{3}{8}$ " deep in them slightly smaller than the $\frac{3}{16}$ " stove bolts that will hold the wheels in place. The steering wheel can be a solid disk, or for realism, you can drill four evenly spaced $\frac{1}{4}$ " holes in it. Fasten the seat with a $\frac{3}{16}$ " strip of sheet metal.

Turn one disk for both fenders and drill a $\frac{1}{2}$ " hole in the center. Cut the disk in half and fit the pieces to the tractor. You'll have to trim some more from each fender, but leave as much as possible where the fenders meet the rear axle. Before gluing on the fenders, check with the wheels on to be sure of proper clearance.

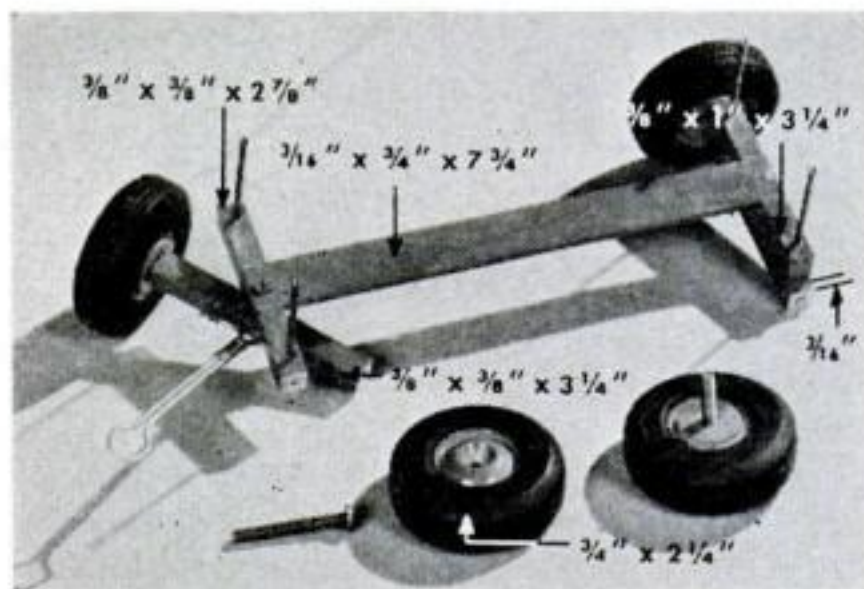
The wheels are turnings, the front ones being grooved in the lathe. Grooves in the



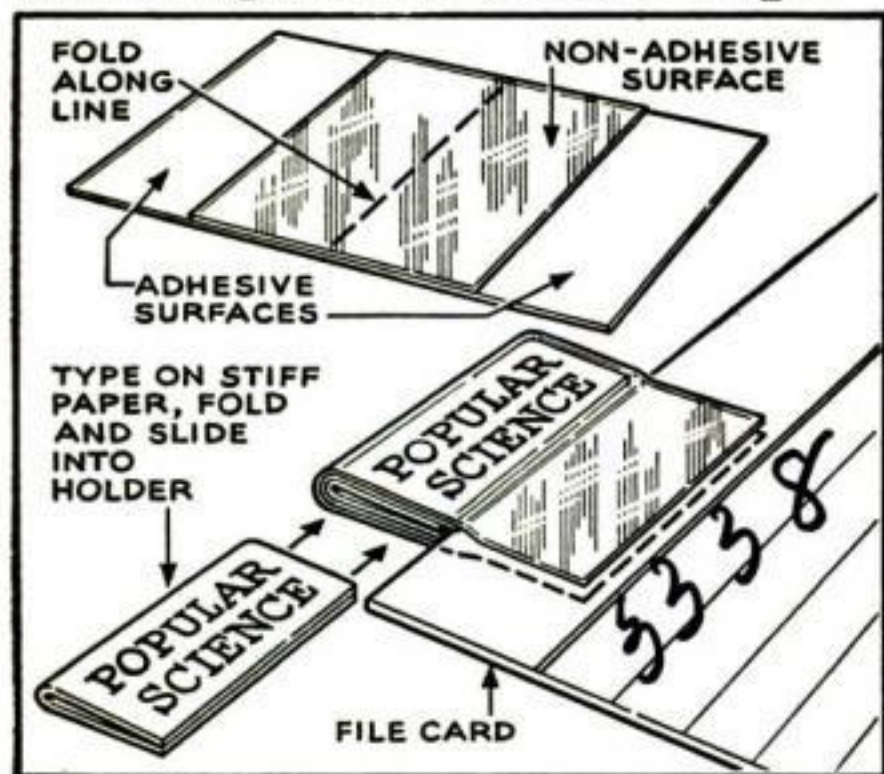


rear wheels may be cut with the dado blade or hand filed. The headlights also are turned and fastened to the body with 1" brads.

Construction of the trailer is simple, as a study of the photo at the right will show. The wheels have the same dimensions as the tractor's front wheels. Bright red enamel will please the kids; the tire portion of the wheels will closely resemble rubber if it is painted a dull black. Paint the trailer to match the tractor—*H. R. Corry, Red Lodge, Mont.*

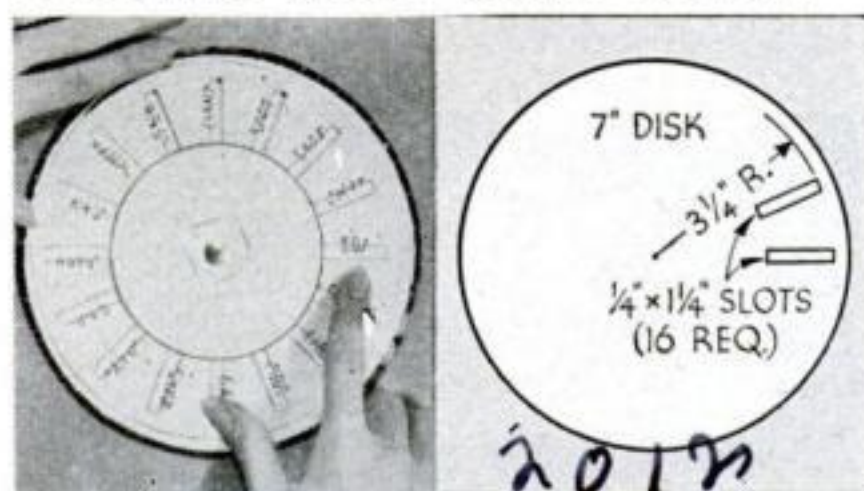


Indexing with Cellulose Tape



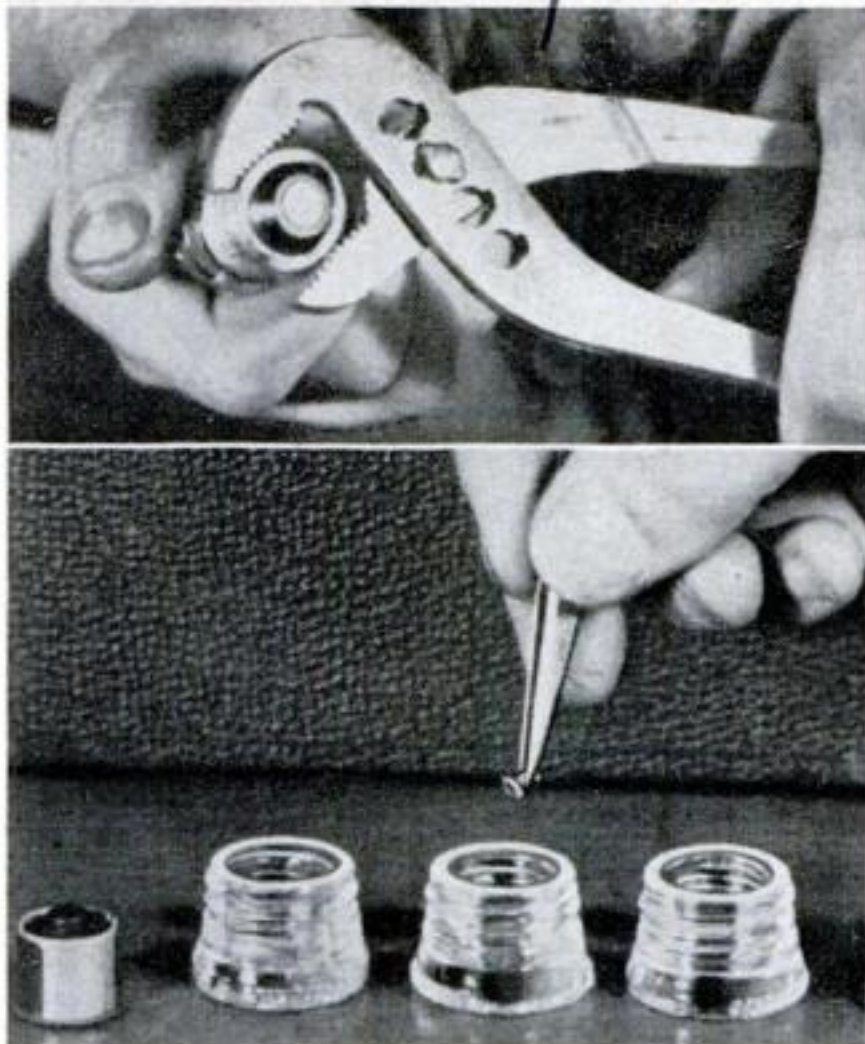
Cut a 1½" strip of transparent tape and lay it sticky side up. Cut a ¾" piece and lay it sticky side down in the center of the other, leaving ⅜" of the first strip projecting at each end. Lay the card or sheet to be indexed on one sticky portion and fold the other over. The double-thick part holds the heading.—*Pat Fey, Manhattan, N. Y.*

Find-the-Word Game Is Fun



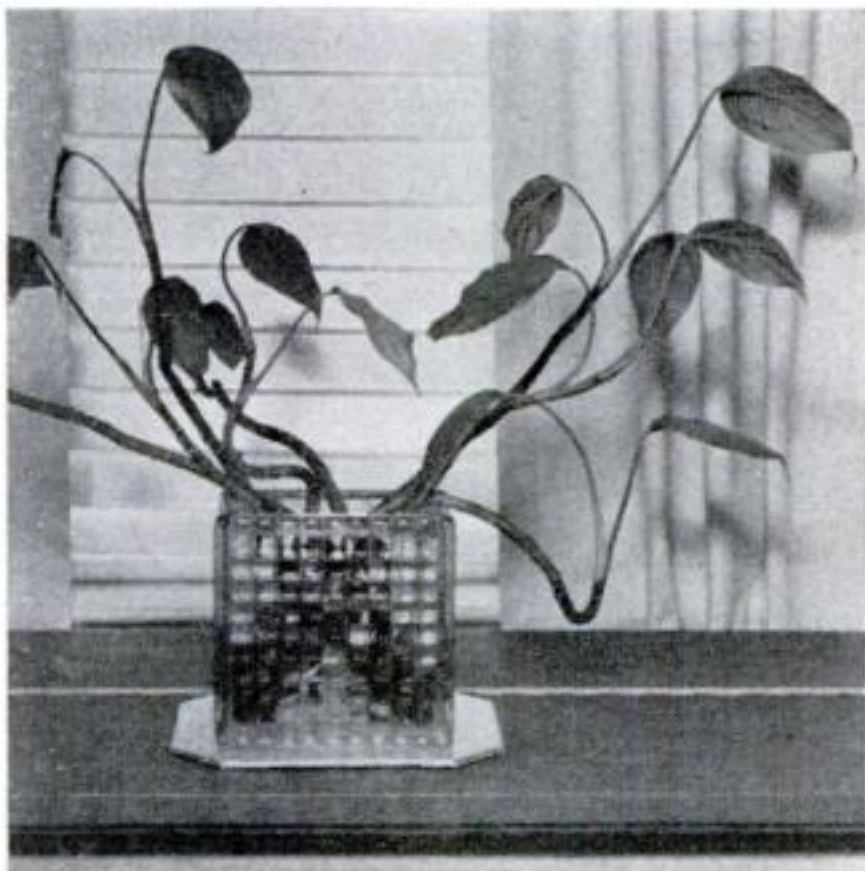
CHILDREN learning to read will like (and be helped by) this simple toy. Part of a word is lettered on the slotted upper disk and part on the lower disk. By turning the upper one, the letters of one word at a time can be made to match. Cut 16 slots in one cardboard disk. Place this over the other and mount both on a base with a thumbtack. Letter the words near the edge of the slots so half of the word is on each disk. Turn the upper disk between the lettering of each word. Then only one word at a time can be matched—*R. J. De Cristoforo, Manhattan, N. Y.*

6307



Old Fuses Are Parts Holders

IF YOU work with small parts, you can make ready containers for them from the glass sections of ordinary household fuses. Remove the metal by turning it off with a pair of pliers as shown in the photo.—*Shepard G. Saunders, Mattapan, Mass.*

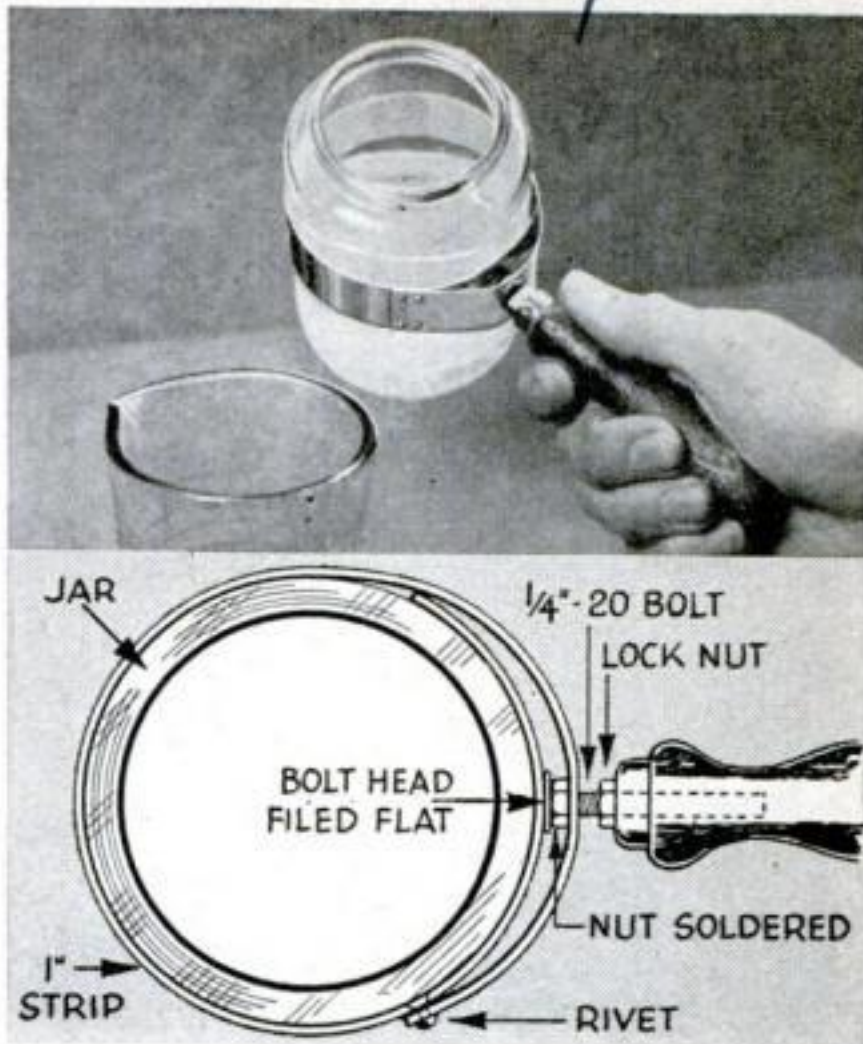


Flowers Grow in Glass Bricks

GLASS bricks that had been damaged on one side were salvaged from a house construction job and made into decorative flower vases. The rough edges of the broken glass were smoothed down with a small hand grinder. A file would do instead.—*Robert Hertzberg, Jackson Heights, N. Y.*

6267

6227



Handle for Glass Jar Locks On

JARS that come with press-on lids make excellent beakers for the darkroom, laboratory, or kitchen when fitted with a removable handle. This is especially useful in handling hot or corrosive liquids.

Cut a 1" band of stainless steel long enough to encircle the jar and overlap 3". Drill a $\frac{1}{4}$ " hole $1\frac{1}{2}$ " from the outer or overlapping end. Solder a $\frac{1}{4}$ "-20 nut over the hole on the inside. Drill a file handle undersize for a $\frac{1}{4}$ "-20 bolt and file the head of the bolt flat. Insert the bolt as shown before riveting the band. Put a lock nut on the bolt, twist it into the handle, and tighten the nut. Turning the handle will lock it.



Gaskets Offered in Kit Form

PACKING and gasket materials of rubber, fiber, and asbestos for repairing leaks are contained in this handyman kit made by the Zimmerman Packing Co., Norwood, Ohio. Leaks in steam, water, gas, ammonia, acid, oil, and gasoline lines may be stopped with washers and gaskets cut from the sheets.

6123



**HANDICRAFT
FOR
CHRISTMAS**

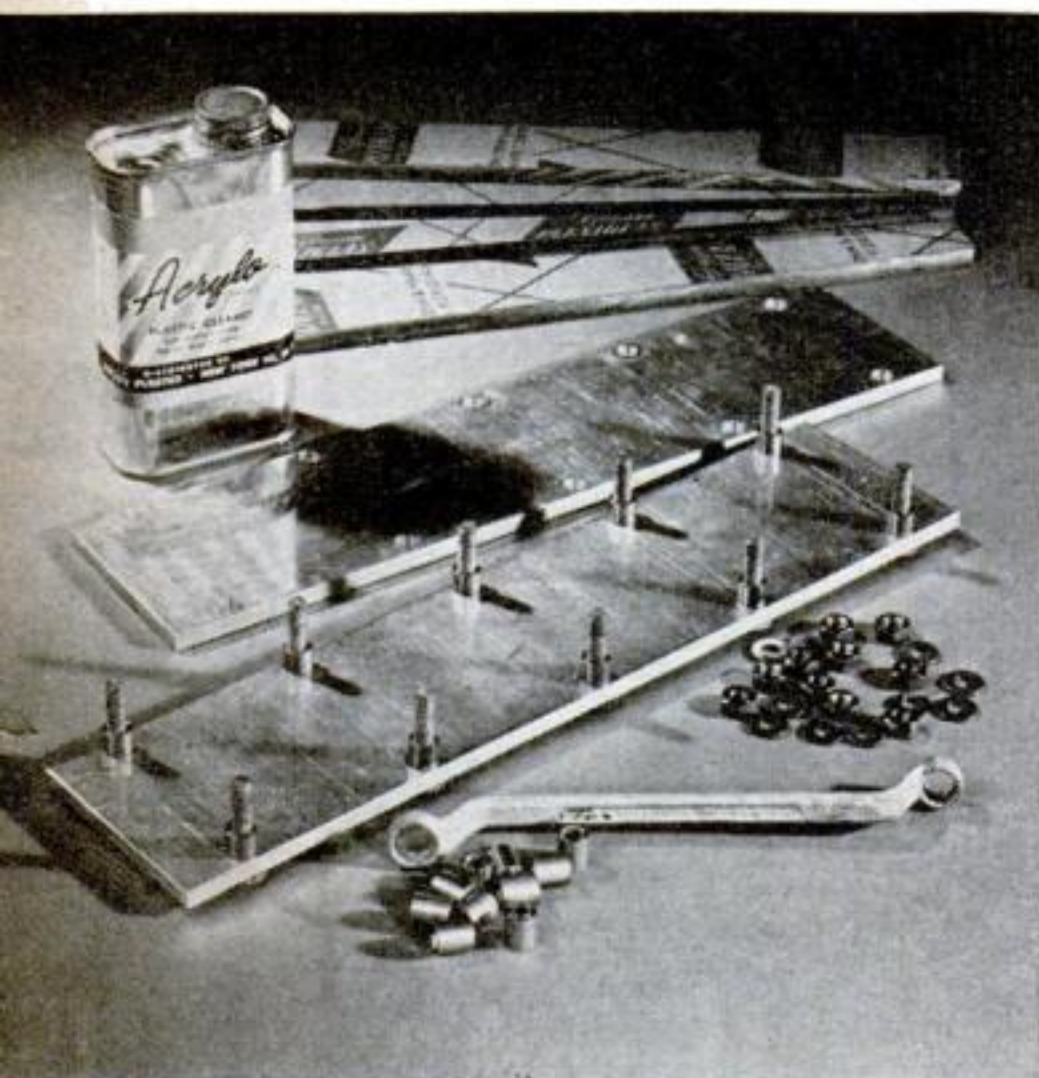


Catching the fancy of any fisherman, these projects have colorful fishing flies embedded in plastic. Lid of cigarette box at left consists of

a clear top sheet laminated to a milky-white one below, behind the fly. The body of the lighter is built of nine pieces.

6285

Press Embeds Objects



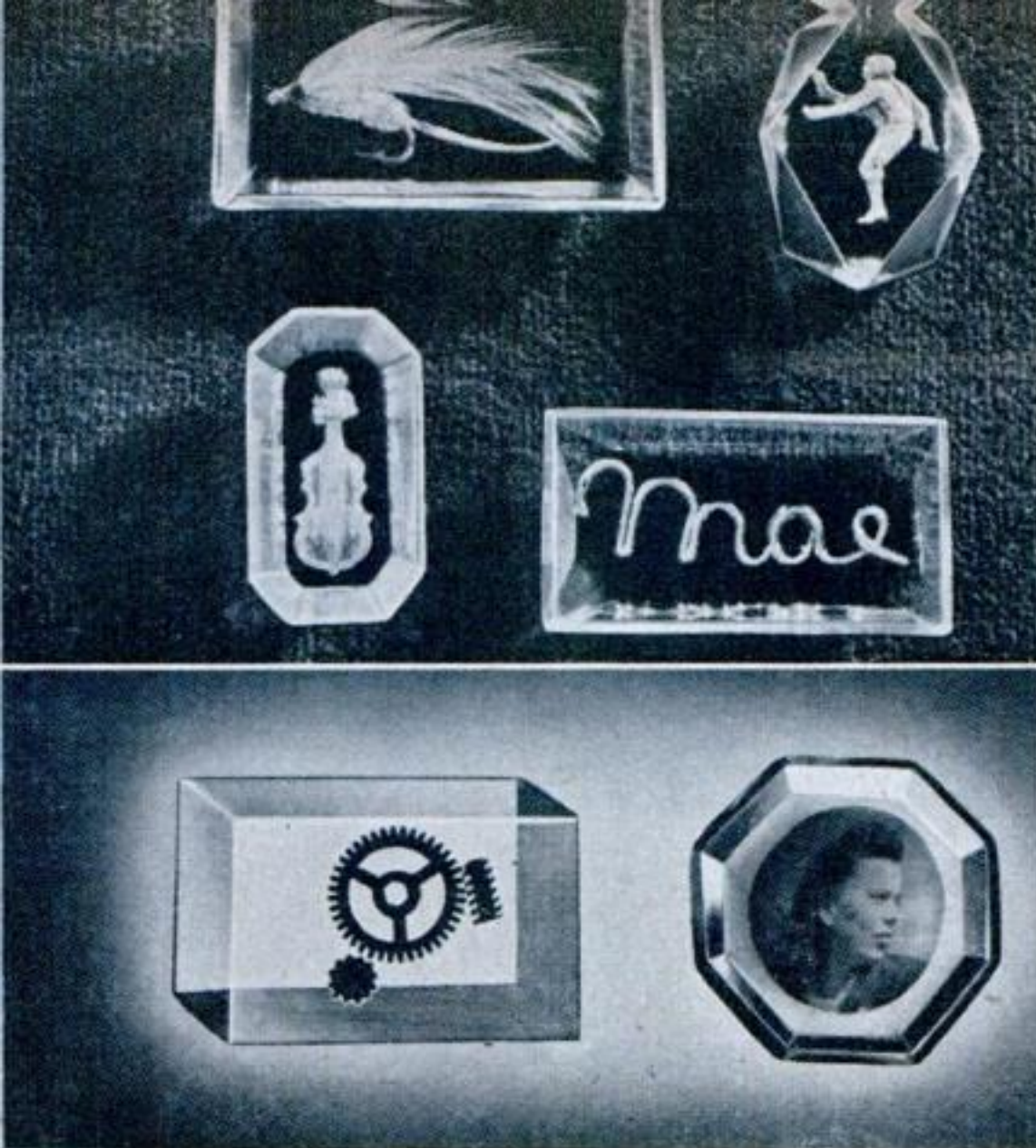
This is the press that does the work. Here the top platen is removed. Kit includes 5/16" and 3/8" spacers, a wrench, plastic, and cleaner.

LOCK two pieces of acrylic plastic and any reasonably thin object in the small but potent press shown at the left, heat and clamp it according to directions, and you'll wind up with a single solid piece in which the object is magically sealed for keeps.

The ingenious Acry-Laminating Press developed by Berton Plastics, Inc., of New York, welds acrylic sheets firmly together. Cut apart, the lamination shows no lines or joints. Coins, medals, charms, fishing flies, beads, butterflies, photos—anything up to about 3/32" thick—can be embedded permanently in Lucite® or Plexiglas®.

The press consists of two platens clamped by bolts and nuts. Precision spacers govern the amount of compression or draw-up of the plastic sandwich. Two sets provide for making laminations 5/16" and 3/8" thick. Longer bolts and spacers are available for such king-size laminations as used in the cigarette lighter above.

As acrylic sheets may deviate a little from nominal thickness, the material must be carefully measured after the masking paper



Small fly makes a brooch (top). Silver charms and medallion at right are set off by colored plastic behind, its edges cut back in faceting.



The name is bent of silver wire. Tiny watch gears are encased in a "box" by reverse bevelling. Octagon contains a color transparency.

in Laminated Plastic

is off. With $\frac{5}{16}$ " spacers, total thickness should be $\frac{3}{8}$ ", not including the object to be embedded. Any combination of thicknesses totaling $\frac{3}{8}$ " may be used.

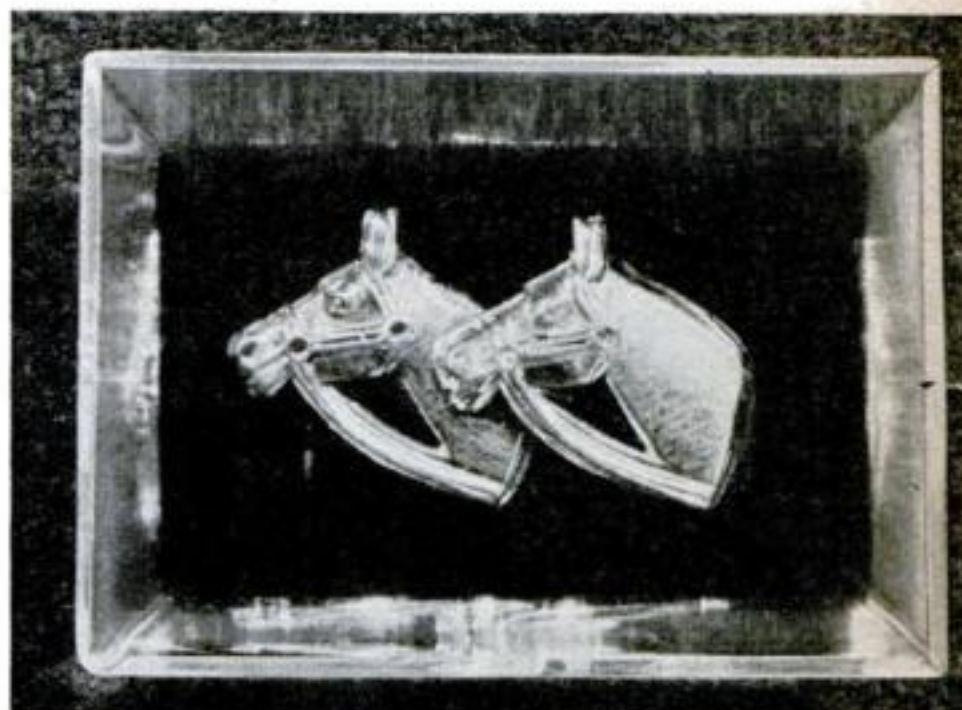
All surfaces are cleaned with the special fluid provided, the sandwich held together with cellulose tape, and the whole lightly clamped in the press. This is left for one hour in the kitchen oven at exactly 275 deg. Then the hot press is removed with gloved hands, and the nuts tightened as far as the spacers permit. The press is at once returned to the oven, with heat shut off, and left for at least three hours.

Unclamped, the plastic looks dull and rough, but faceting and polishing bring out all its natural sparkle and brilliance. Various front and back bevels should be formed at 45 deg. All the pieces shown were faceted free-hand on a sanding disk.

Don't bevel right up to the insert, for the pieces will fall apart if no plastic is left to bond them. If photos and transparencies distort or tear with the draw-up specified, use thinner plastic or special spacers.



Handsome name plate of ready-stamped paper letters sandwiched between black and clear stock.

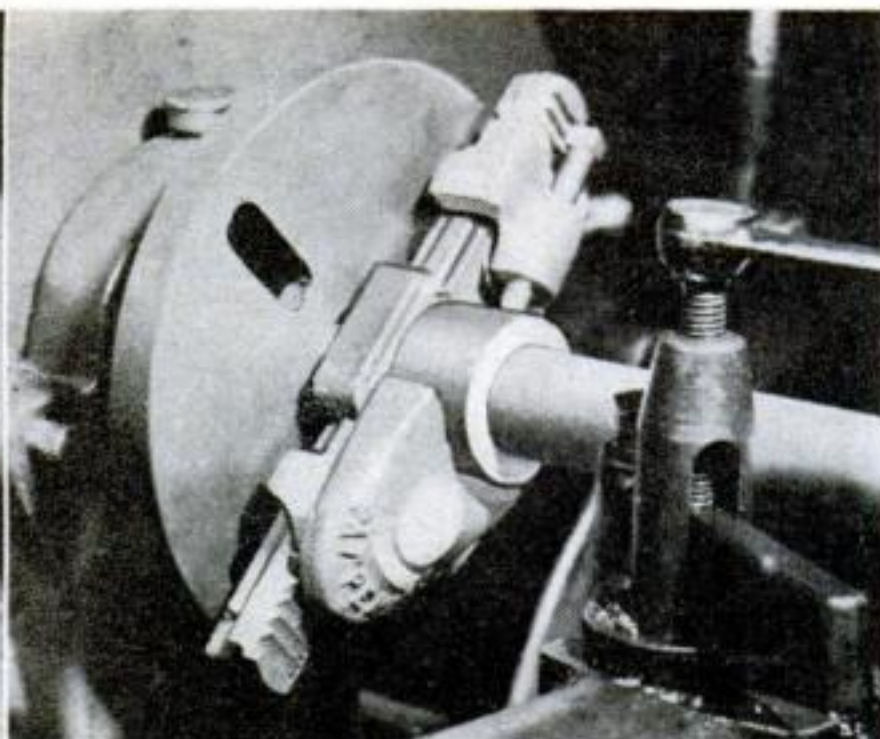


Metamorphosis of a dime-store brooch. Pin was cut off and metal ornament laminated in green and clear Plexiglas®. The back is beveled.

6258



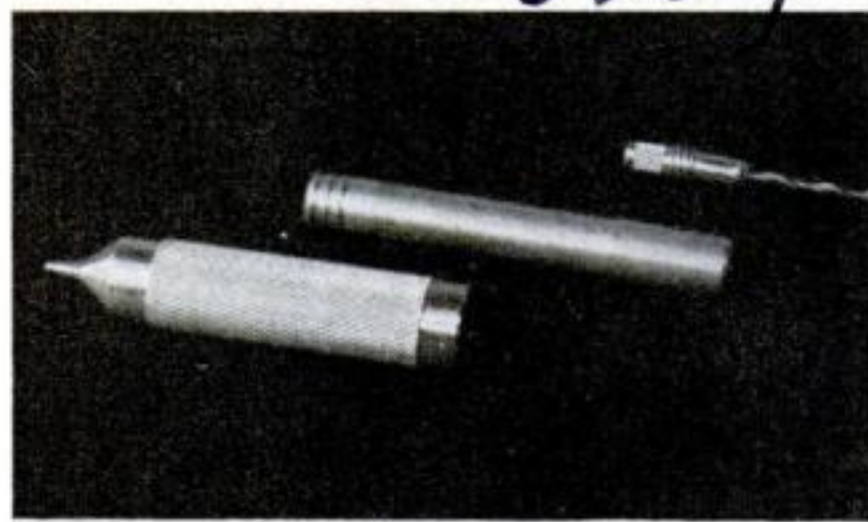
Dog Vise Has Many Uses. Jaws are independently adjustable on this universal dog vise, made by Deroy Products, Inc., Louisville, Ohio. As a safety precaution, the rack has pins to prevent the jaws



from loosening during use. The tool is adaptable for use on 9" to 12" lathes (right), as a work holder in a vise (left) or drill press, and for various other jobs around the shop. It costs about \$8.



Light Built into Ruler Case. When you must take a measurement in a poorly lighted spot, here's a 72" snap-back flexible steel ruler that gives all the illumination you'll need. A small flashlight built into the case throws light on the etched figures where you want to take the reading. About the size of a package of cigarettes, the ruler easily fits in a pocket. It's made by Cowhig Industries, Boston, Mass.



Injects Glue into Joints. When you're mending loose joints in furniture, here's a gadget that puts the glue where it'll do the most good—inside the joint. At one end is a tiny drill for making a hole into the heart of the joint. At the other is a syringe for forcing glue into the hole under considerable pressure. A product of the Duplicon Company, Inc., Hopkinton, Mass., the injector sells for \$1.25.



Level Also Measures Angles. A combination level and angle indicator is made by the R-D Company, Flint, Mich. Degree calibrations on the dial make it possible to find the relation of angular surfaces to horizontal and vertical surfaces quickly and accurately. Weighing about 24 oz., the tool has a $\frac{3}{8}$ " by 3" by 16" aluminum frame. A plastic disk protects the dial. If necessary, the horizontal and vertical vials are quickly replaceable at nominal cost.

6246

Midget Carving Tools Do Fine Work

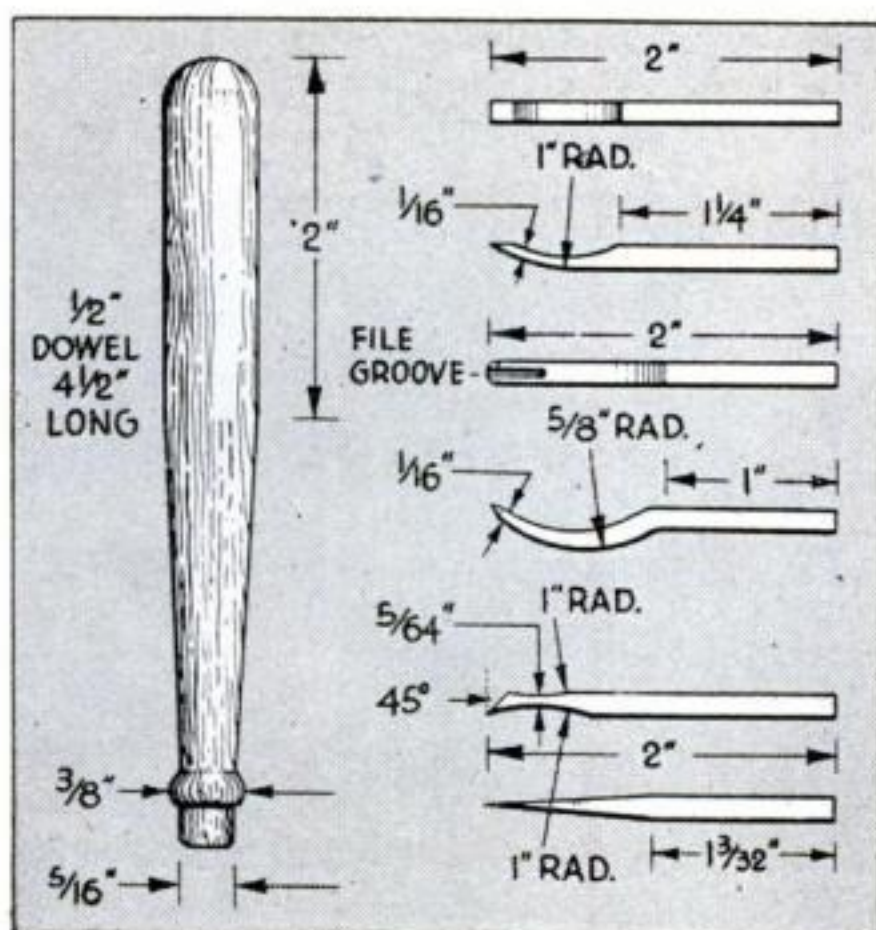
YOU might succeed in driving tacks with a sledge, but it's easier with a tack hammer. Likewise, if you've ever attempted fine carving, you know ordinary carving tools don't fit the job. These midgets do.

File them to shape from $\frac{1}{8}$ " drill rod. Rough out the cutting edge, bend the tool to its particular shape, and polish off all tool marks. Leave the sharpening job until the tool has been hardened.

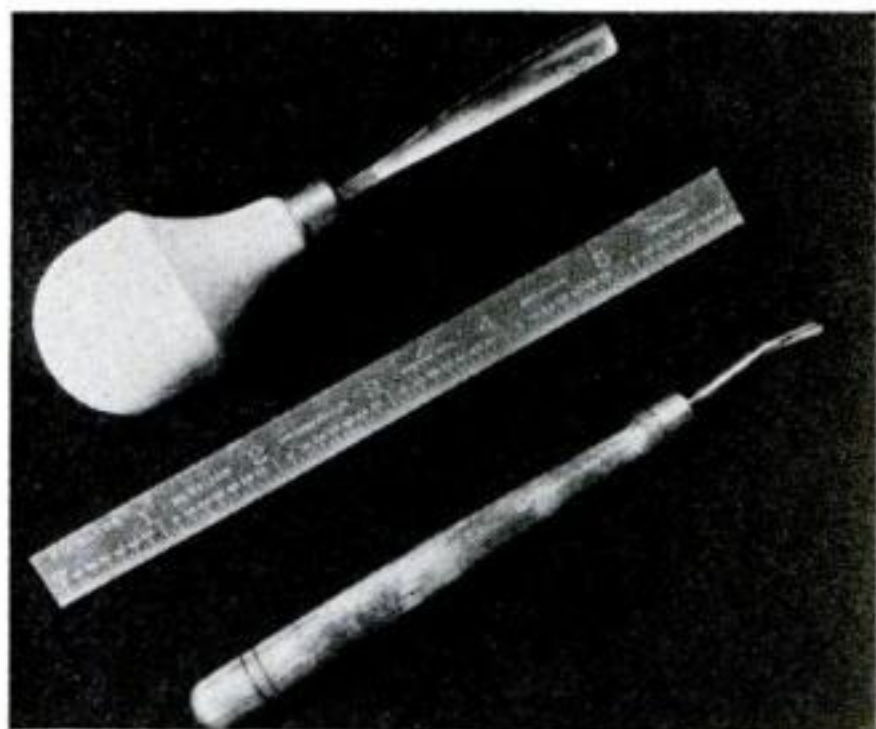
To do this, hold the tool over a gas flame until it's bright red for $\frac{1}{2}$ " back from the cutting edge. Plunge quickly into water, brine, or old crankcase drainings. If a file then slides over the hardened surface without biting in, the job was successful.

Next, polish the tool until shiny and hold the tang end over the flame for a few seconds. Carefully watch the bright surface, until you see a light straw color, followed by a dark straw and purple, start toward the cutting edge. When the dark straw color has reached the cutting edge, quench the tool in water at once. Finally, sharpen the edge.

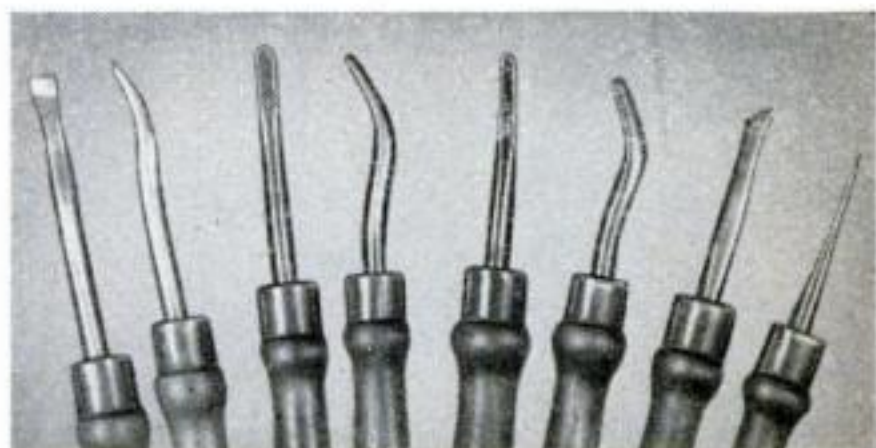
After shaping and polishing the handle, force on a ferrule cut from $\frac{5}{16}$ " copper tubing. Drill a hole for the tang, clamp the tool in a vise, and lightly tap the handle on. —J. L. Van Horne, Florence, Mass.



Delicate carving like the decorative work on this pipe is a cinch with the tools described here. They're small enough to fit the job.



Here you can see how small the midget tools are in comparison with an ordinary carving gouge. Handles are shaped from maple dowels, soaked in linseed oil, and then polished.



Four different tools in plan and side view. Drawings at left show three basic types—chisel, gouge, and skew. You can make many different sizes and variations of these.



NEW SHOP IDEAS

6277

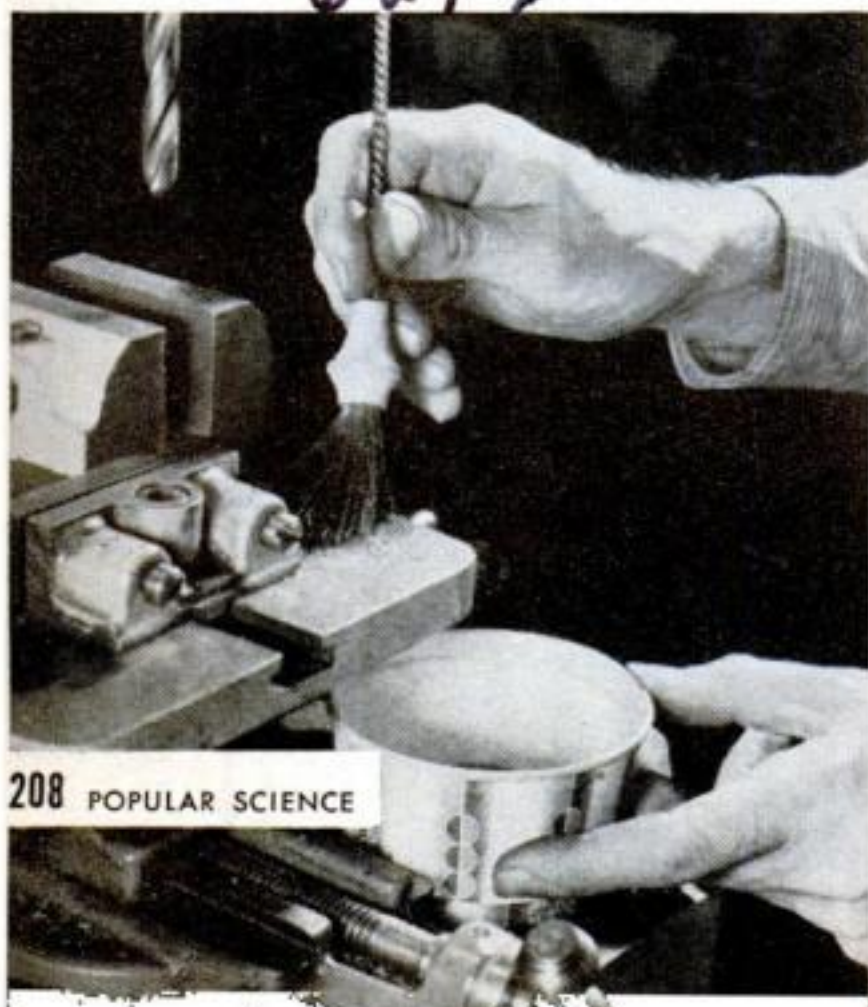


Parallel Is Height Gauge. Accurate layout often calls for a vernier height gauge, but this tool is too costly for most home shops. However, one or more adjustable parallels, available for \$2 apiece or less, will often serve. To use, set the parallel to the desired width with a micrometer, lock the screw, place the parallel and the work on a flat surface (say, a machine table or a piece of plate glass), and mark carefully

across the top with a sharp scribe. Several parallels may be stacked for longer distances. One refinement is to coat a side of the parallel with marking blue, scribe an index line, and make witness marks as shown. Determined by micrometer settings, the marks may show .01" steps in the width of the parallel. They'll be far enough apart to let you set by eye down to about .002".—*Joseph Tracy, Manhattan, N. Y.*

Kitchen Comes to Shop. A pastry or butter brush is very useful for cleaning out sharp metal chips around lathes or drill presses. A roll of paper towels comes in handy for wiping up oil or cleaning paint-brushes. Paper cups or ice-cream cartons are fine for holding nuts and screws when you take machinery apart, or for mixing up small batches of glue. A reground paring knife makes a good insulation stripper.

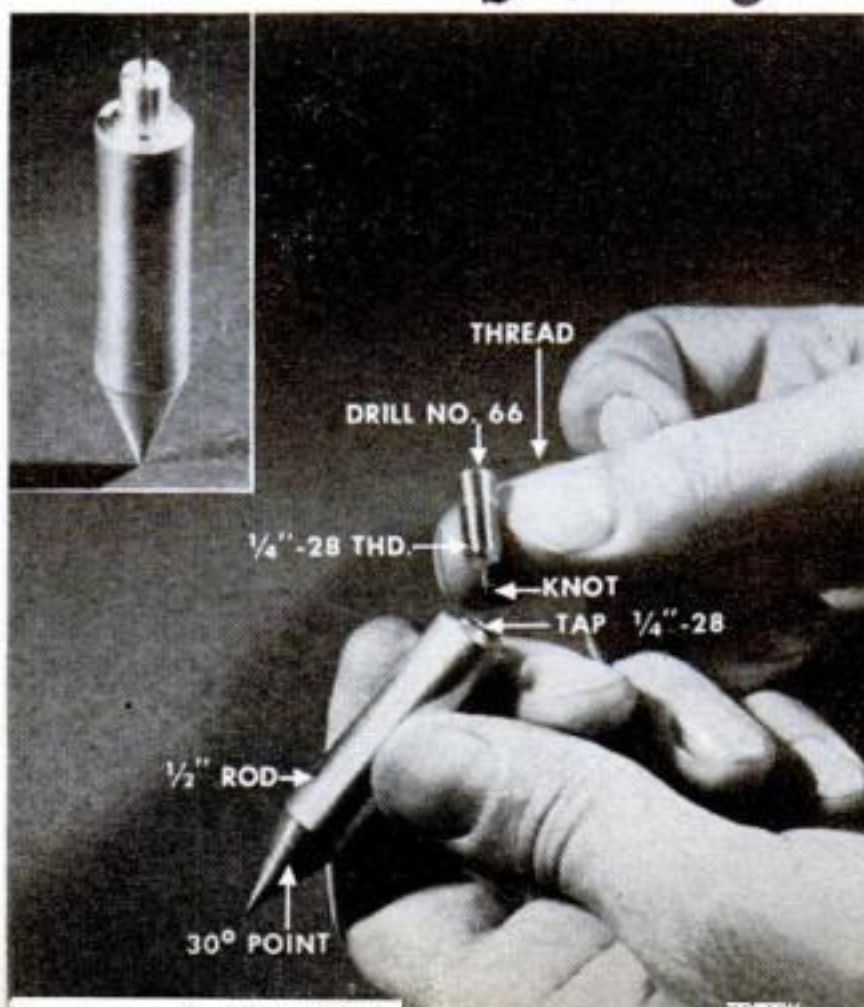
6212

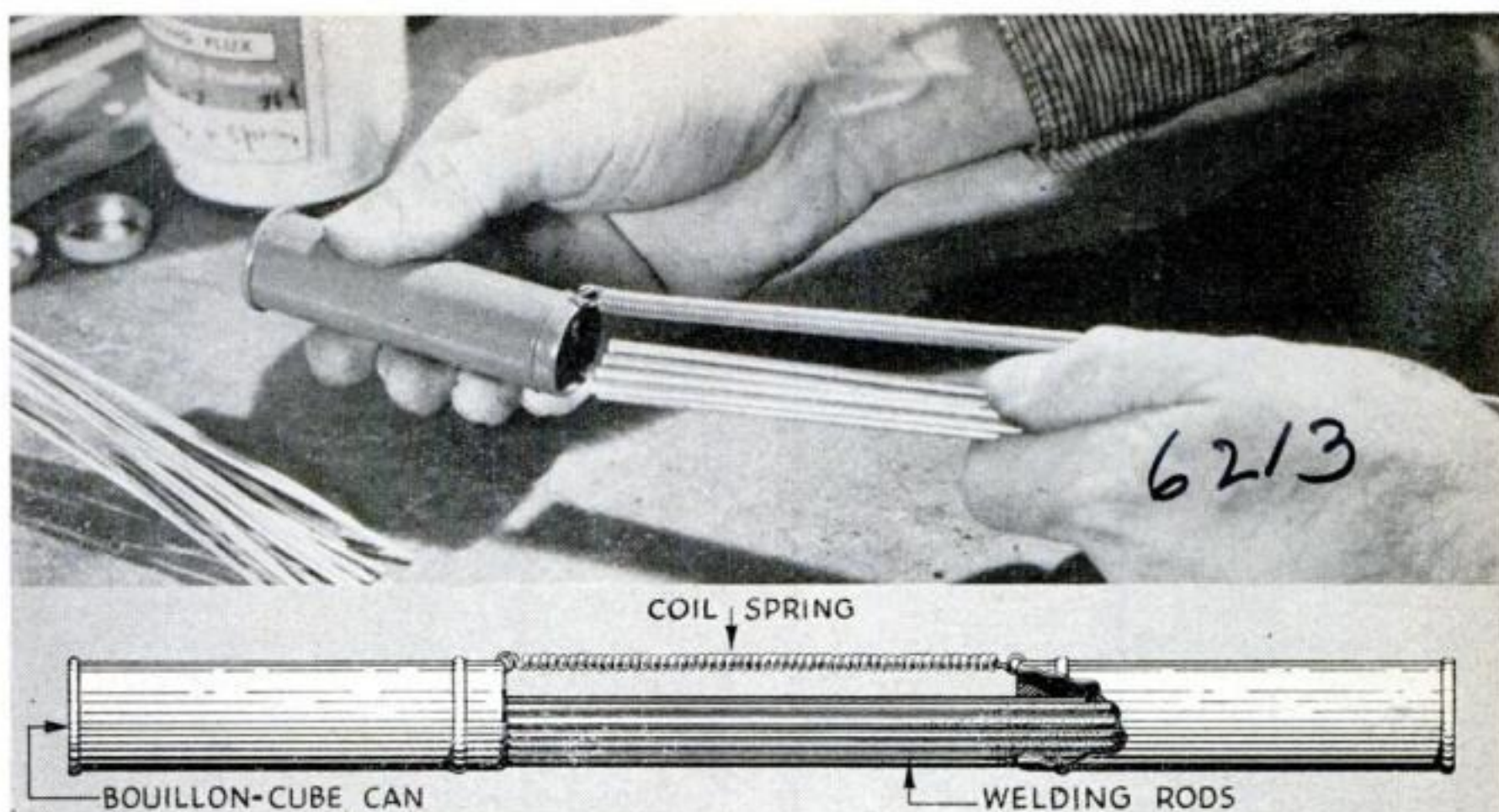


Plumb Bob Is Simple Turning.

Many times a plumb bob and level will do a faster and more accurate job than a square. This little bob, turned from 1/2" brass stock or drill rod in a few minutes, is certain to be accurate if you take reasonable care to center the holes. The cord is fed through the threaded stud and secured with a knot. Light fishline is good, since it has little tendency to untwist.

6288





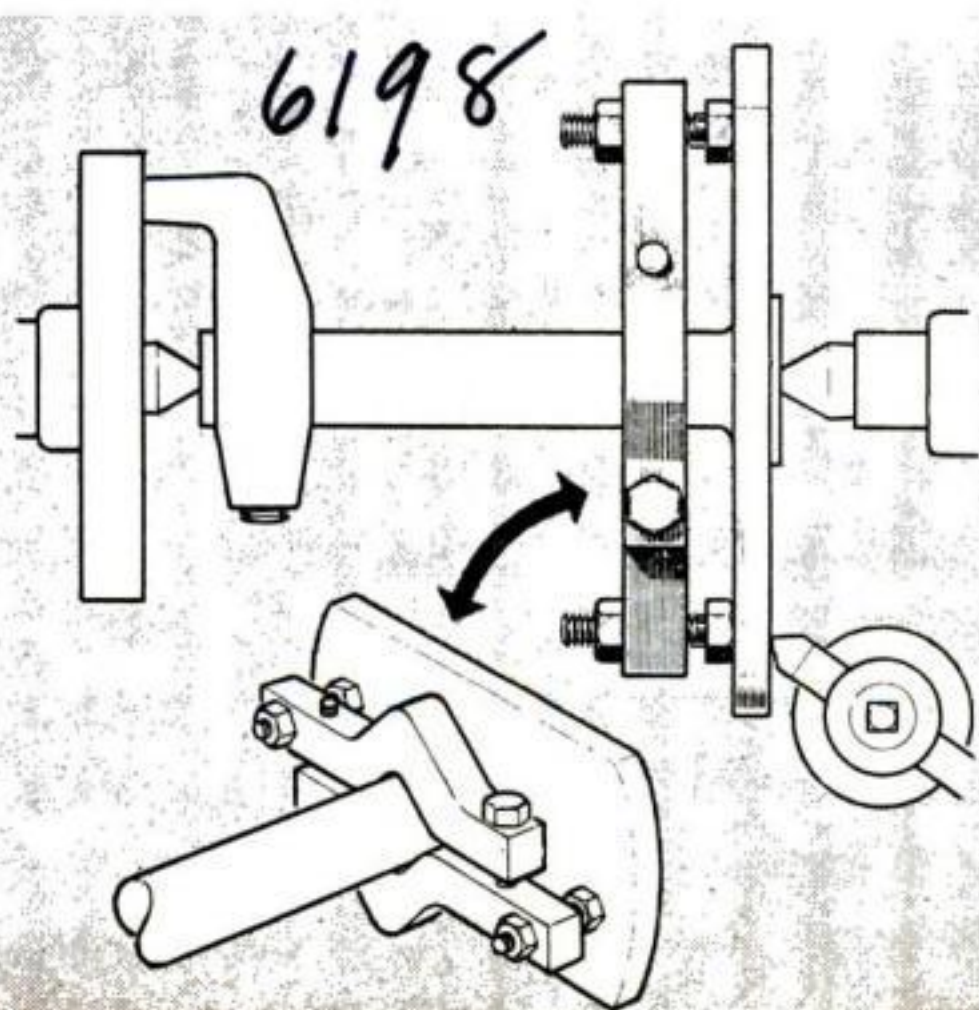
Quiver Holds Welding Rods.

Two 3" metal tubes—the ones bouillon cubes come in—and a coil spring make a convenient quiver for welding or brazing rods. Near the open end of each tube drill a small hole. Bend the spring ends so they hook securely into the holes. Distance from bottom to bottom of the tubes, with the spring relaxed,

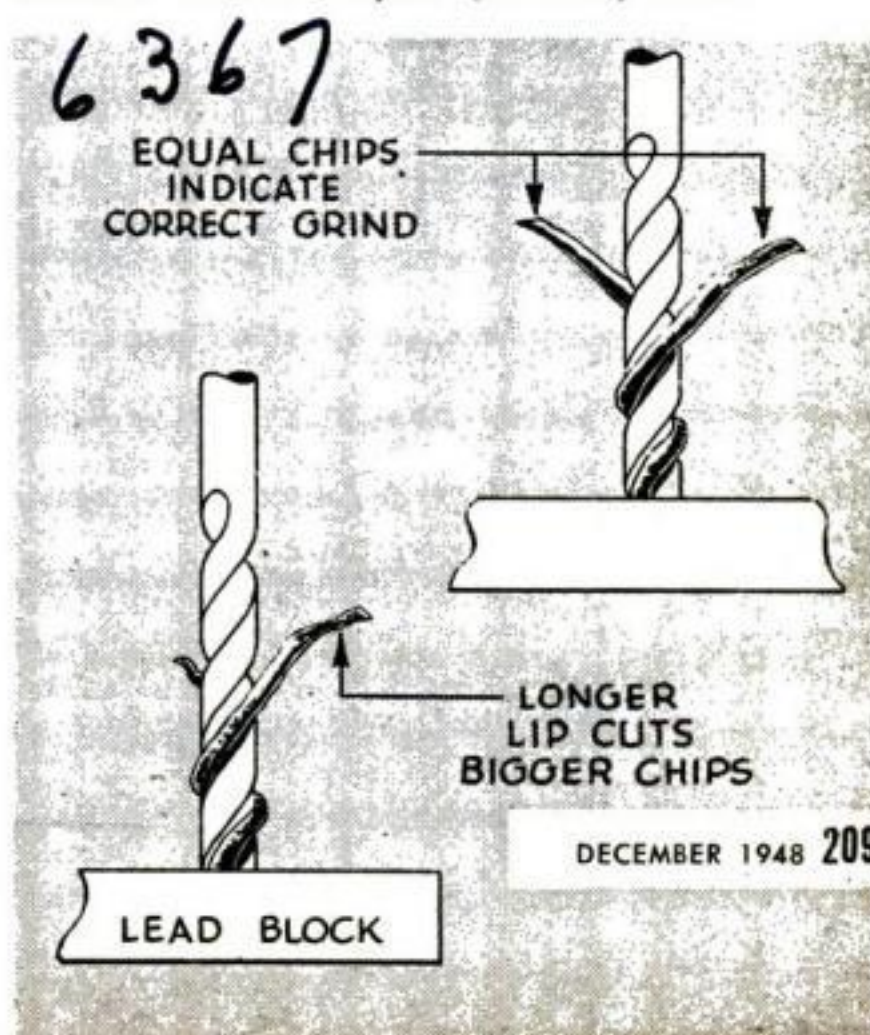
should be slightly less than the length of the rods. Slip one end of the rods into a tube. Then stretch the spring to fit the rods into the other tube. This holder also protects chisels or other pointed tools. Pads of cork should be inserted in the bottom of the tubes to protect the points of such tools.—W. E. Burton, Akron, Ohio.

Dog Supports Flange for Facing.

I had to face a thin flange in the lathe but was having trouble due to deflection under cutting pressure. A driving dog of the balanced type, made from bent flat bars, suggested the solution shown below. Holes for hexagon-headed bolts were drilled and tapped through the arms of the dog. The boltheads were adjusted to bear on the flange and locked in position by nuts to support the flange against cutting-tool pressure.—Clifford T. Bower, Decatur, Ga.



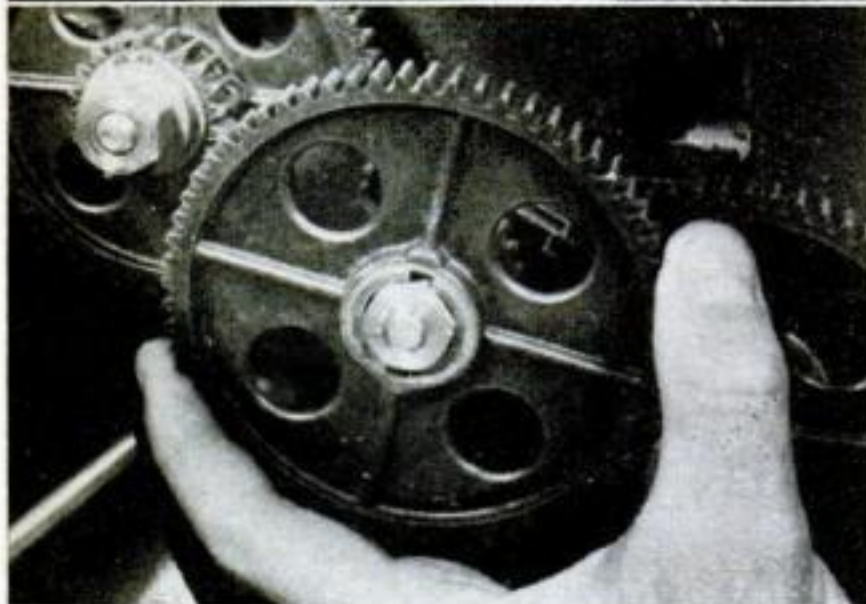
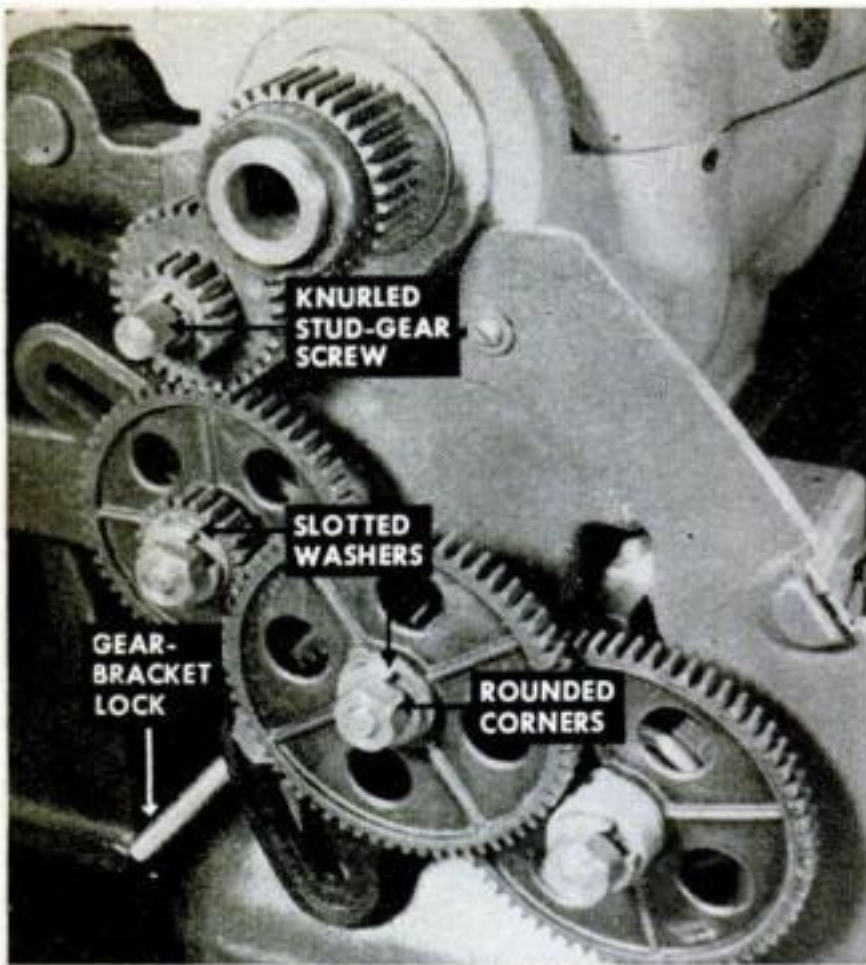
Lead Block Tests Drills. To check the accuracy of a drill, run it slowly into a block of lead. The wormlike lead chips that crawl up the flutes will show you if the drill is improperly ground. In the drawing at left below, the long chip on one side indicates that one lip has not been ground enough. Trace the chip to the tip of the drill and you can tell which lip to grind a trifle more. Repeat the testing and grinding until you get the result shown in the other sketch.—Herbert Pfister, Bronx, N. Y.



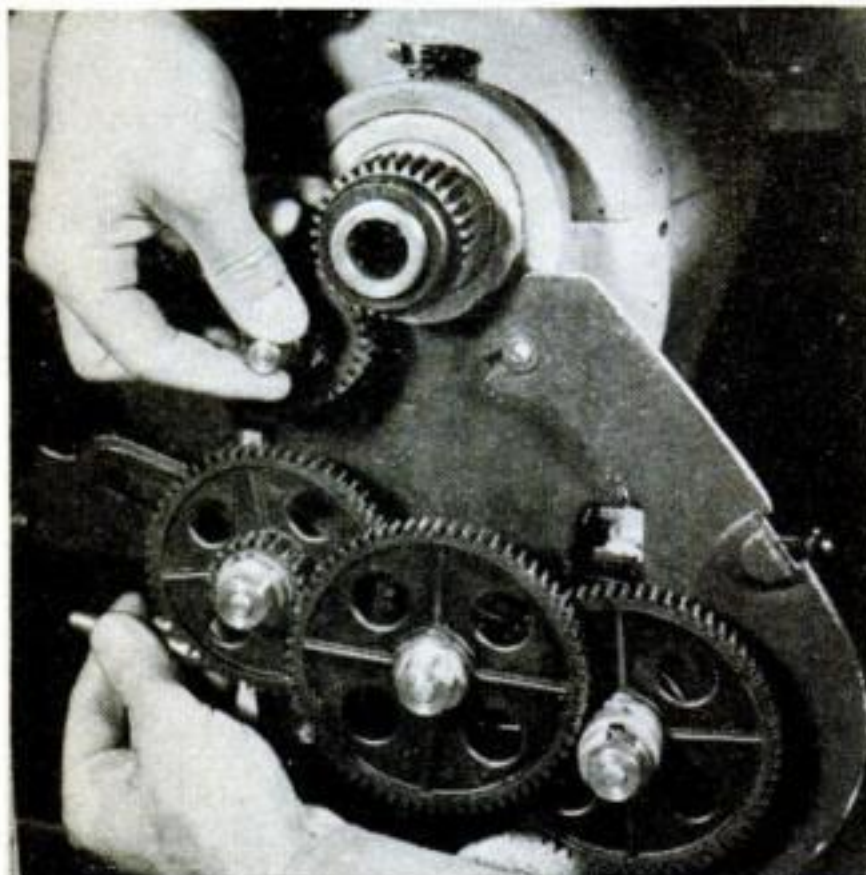
Change-Gear Setup Speeds Lathe Work

By W. S. Kals

6194



Loosen the nut, slip off the washer, and gear slides off. Necessary operations: slotting the washer and turning off corners of the nut.

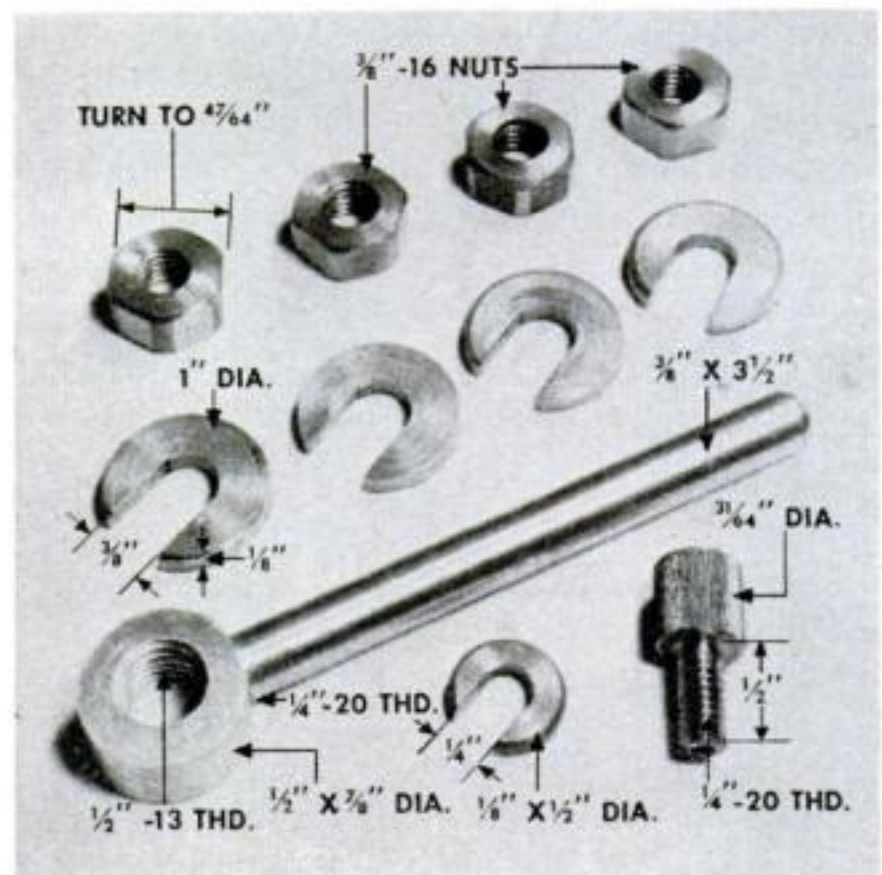


Reversing stud gear is a moment's job. Loosen the bracket and the knurled stud-gear screw, and slide off the washer. On lathe shown this gear alone halves or doubles feed.

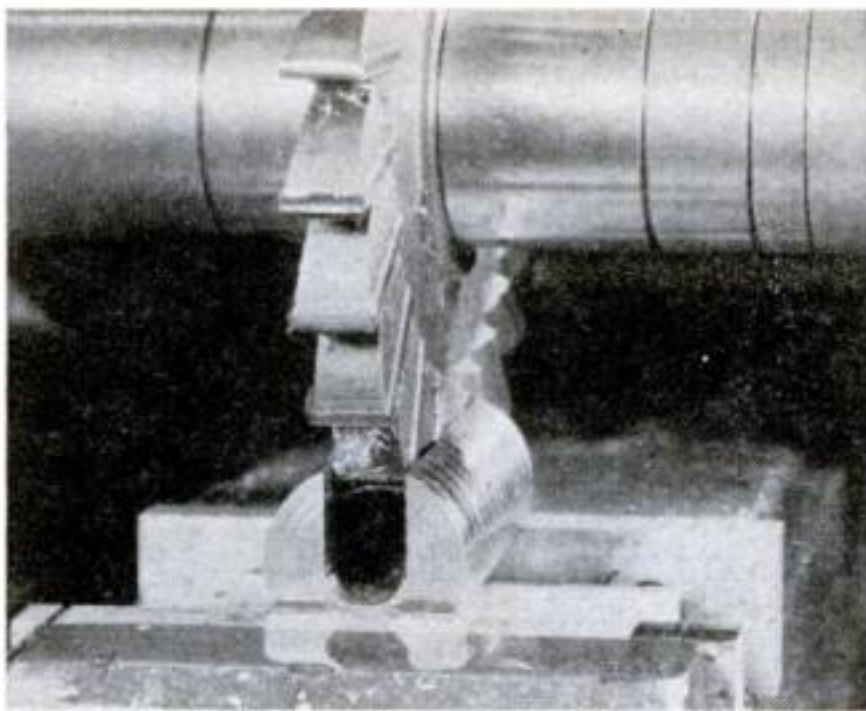
AT FIRST glance the change gears at left may seem conventional. But a few dodges make it possible to switch them in a jiffy, rendering the various feed ranges more readily available, so that you'll use them rather than hand feed. Threading set-ups are easier too. The cost? Some scraps and a little time.

Dimensions, where shown, are for the 10" lathe in the photos. By altering them, most if not all of the system can be applied to other lathes. On this one, a threaded collar with a handle replaces the nut that locks the gear bracket. A pull swings down or locks up the bracket. Make the threaded collar first. Turn it into place and mark the point on it where the handle should go for convenient operation. Tap the collar and screw in the handle.

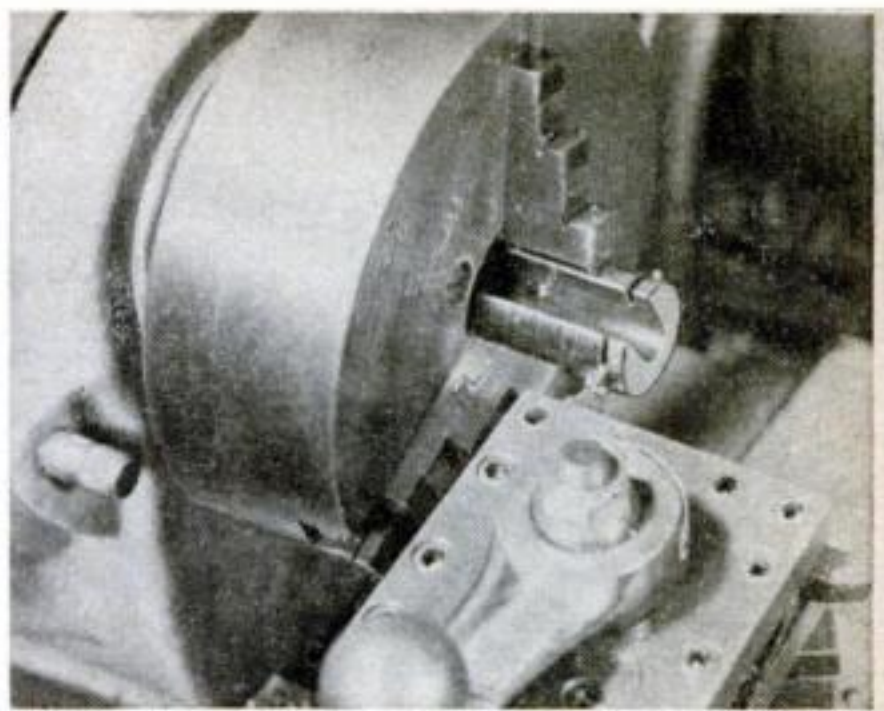
Since the bore of the gears is only slightly smaller than the nuts, two changes make quick gear removal possible. First, all the washers are replaced with slotted ones,



Make two simple parts, and alter washers and nuts as shown. This converts standard Atlas ® setup for speedy gear changes as shown in the photos at left. Nothing else is altered.



Slotted washers can be hacksawed or made in multiple by milling a drilled piece of stock as above. Center a cutter of suitable width over the piece. Chamfer edges with a file.



Chuck slotted piece in lathe, and with slow feed part off washers. Bit in right-hand corner of turret was fed straight into cut to chamfer washer edges before cutting through.

so that merely loosening the nuts will let you slide off the washers. Second, the nuts are rounded off to let the gears slip over them once the washers are removed. To do this, chuck a screw of the same thread, screw on a nut (preferably against a somewhat smaller washer) and turn corners off.

You can hacksaw slots in the washers provided with the lathe, or make a set of new ones. They're handy, incidentally, for holding work or a vise on a milling machine

or drill press, making special tool-post set-ups, and so forth. Drill a piece of round stock and either hacksaw or mill out the slot. File a slight chamfer on its edges. Chuck the piece in the lathe and with a cut-off tool part off washers, feeding very slowly to avoid catching the tool in the slot.

A slotted washer and a knurled screw make it possible to reverse the stud gear quickly. This halves or doubles the feed, often all you need for roughing and finishing.

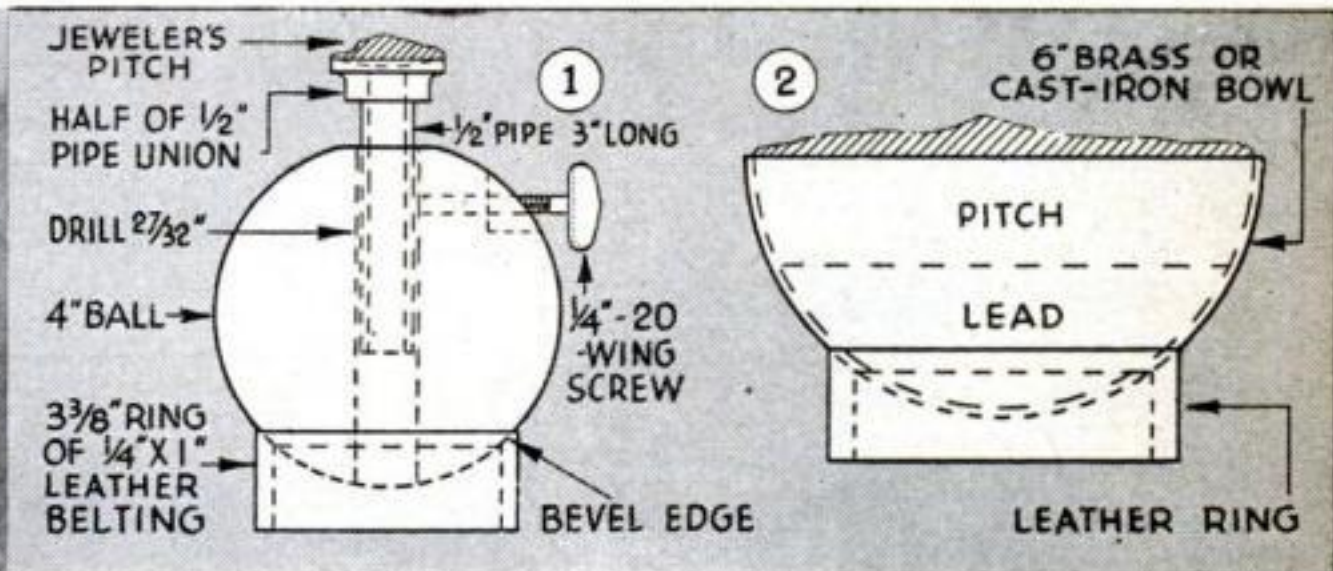
Engraving Support Made from a Damper Ball

IN CHASING or engraving jewelry and the like, it's a problem to hold the work securely. The professional jeweler's ball is too costly for the amateur. Two easily made substitutes, shown below, hold the work firmly at any angle the craftsman prefers.

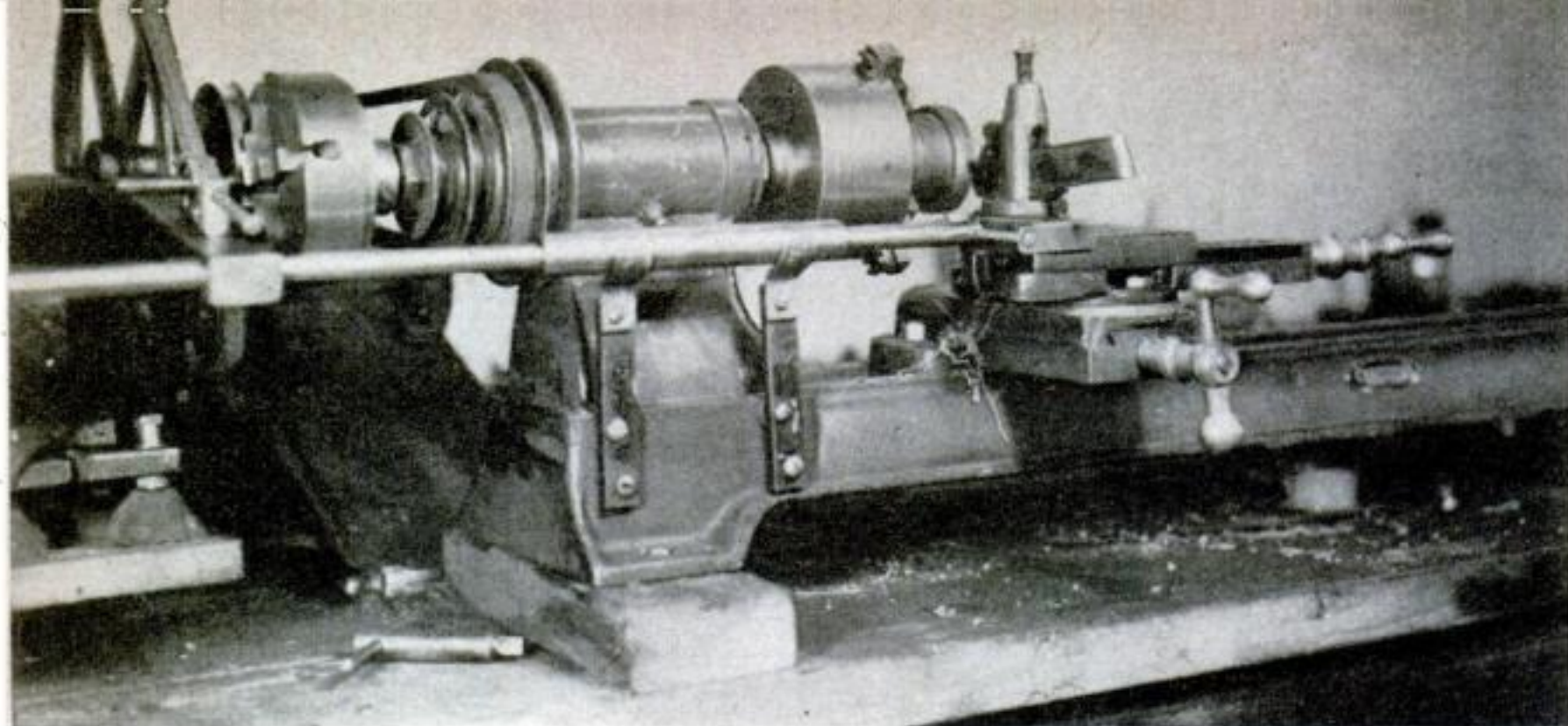
The one shown in the photo was made from a cast-iron ball used to counterbalance furnace damper controls. It already had a hole and setscrew, and required only something to hold the work. A $\frac{1}{2}$ " pipe nipple 3" long and half a pipe coupling serve this

purpose. The work is set into pitch poured into the coupling member. Some $\frac{1}{4}$ " by 1" leather belting was chamfered on one edge and riveted into a ring for the base. A hemispherical ashtray forms the other work support. It was first half filled with molten lead, and then poured full of pitch.

Jeweler's pitch is melted and poured on the support. When the pitch is almost solid, the lightly greased work is pressed in. For removal, it is heated gently until it can be pulled out.—R. C. Collins, Elizabeth, N. J.



6067



Cutting a $1\frac{1}{4}$ " thread on a wood lathe. Tool is fed in only a few thousandths at a time. Mo-

tor is reversed to return tool for next cut. Start beyond work to take up slack before tool cuts.

73483

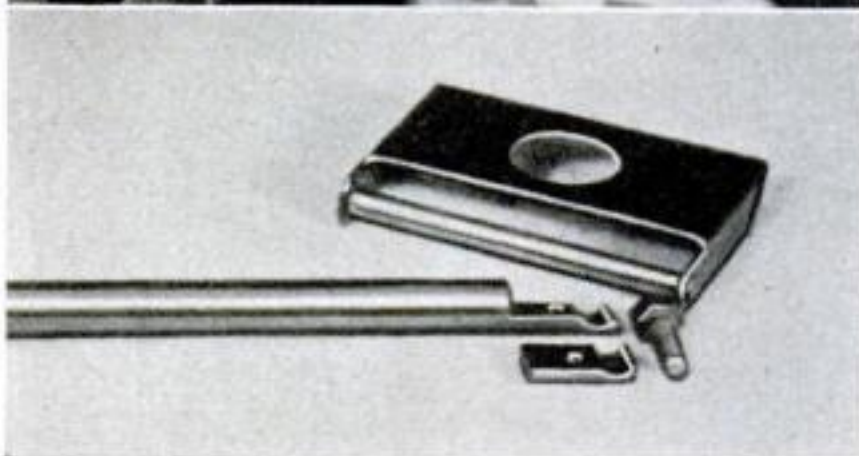
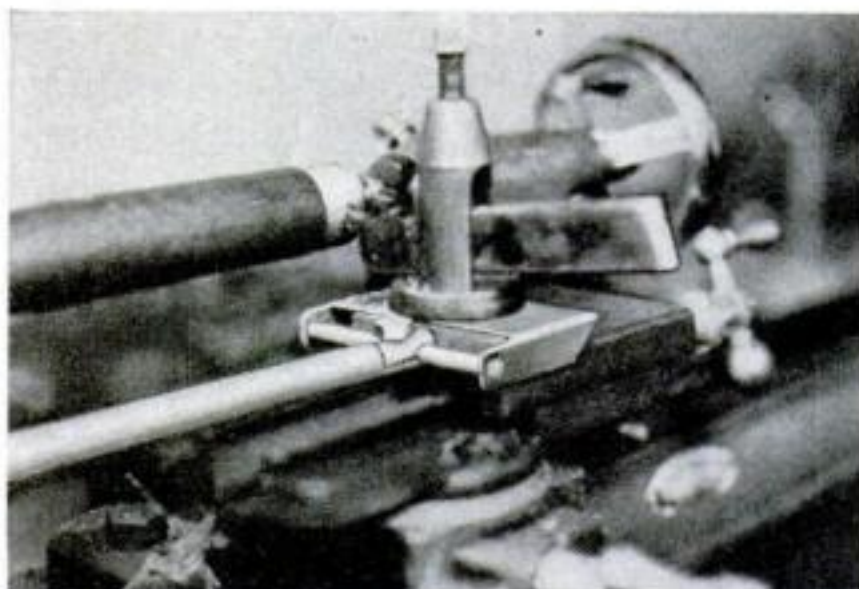
Threading Without a Lead Screw

MAYBE you've never thought of cutting threads on your wood-turning lathe. But if you can mount a chuck on the outboard end and if you have a slide rest, it will creditably cut almost any thread.

The nut is removed from the longitudinal feed of the slide rest, permitting the top slide to move freely parallel to the ways. A bolt or other piece with the desired thread is clamped in the outboard chuck, and a small pointed dog mounted to follow the thread groove is connected to the tool slide.

At the tool-post end, a sheet-metal fixture is clamped under the rocker collar. The $\frac{1}{2}$ " tie rod fastens to this fixture and is supported on the lathe in a bushing or tube.

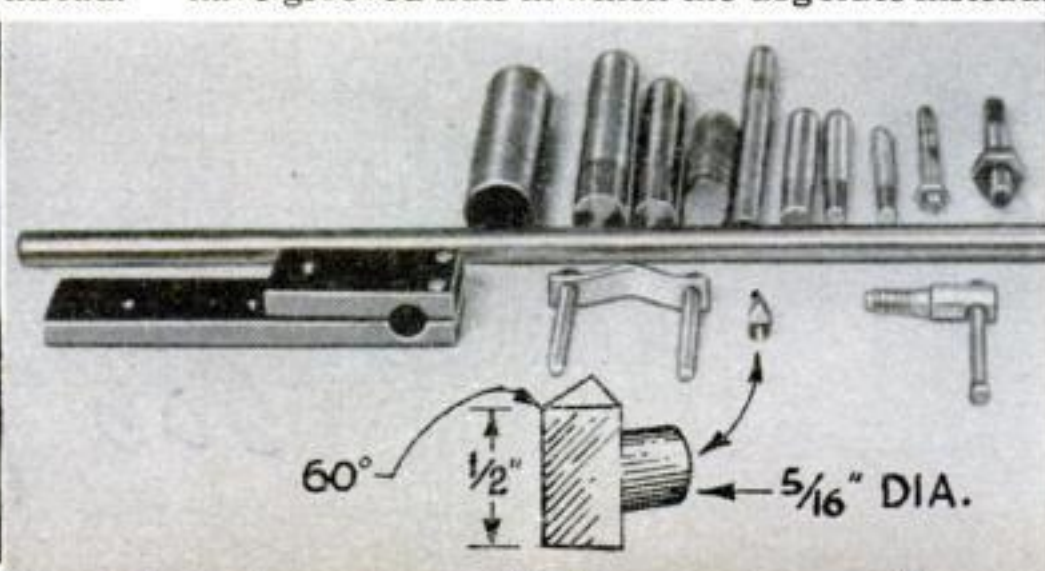
On the outboard end, a clamp made of $\frac{3}{8}$ " steel is secured on the tie rod with a single big T-handled bolt. It has two tapped holes for the strap bolts and a $\frac{5}{16}$ " hole for the follower dog. Tighten the clamp to draw the dog into the thread but allow free rotation. Feed the threading tool in only about .002" at first.—*Raymond R. Dunford, Portland, Ore.*

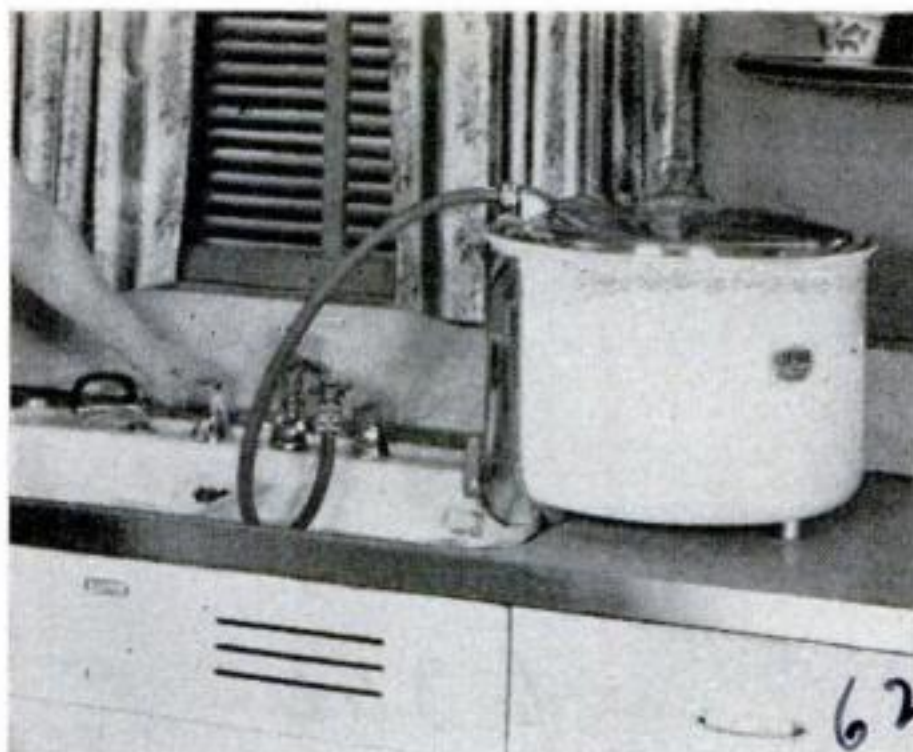


Make tool-post fixture $\frac{1}{2}$ " wider than slide to permit angle setting for taper threads. Split tie rod clamps around $\frac{1}{4}$ " rod riveted between turned-down flanges of sheet-metal body.

Threaded pattern is chucked outboard. Clamp on tie rod holds pointed dog in the thread.

Studs with 24 and 32 threads, extreme right, have grooved nuts in which the dog rides instead.





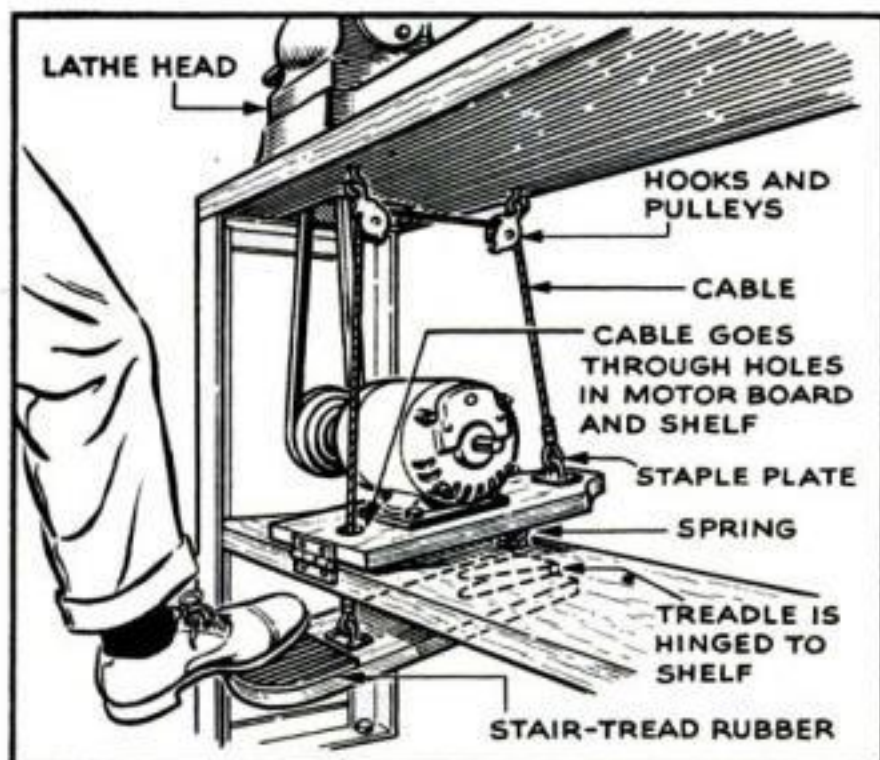
Water Jets Wash Your Dishes

HERE'S a water-powered dishwasher that doesn't need any electrical or permanent water connections. Although small, it'll take the average service for four people, as many as 22 pieces of china plus silver, at one washing.

After stacking the dishes in the basket, you connect the hose to the faucet, put in a little detergent, and turn on the hot water.



Two jets spin the basket, and two others spray directly on the dishes. When the suds flow over, you open a drain valve and force water through until the dishes are rinsed. Made by the Cameron Corporation, Cleveland, the washer sells for around \$50.



Treadle Disengages Lathe Belt

HERE'S a clutch arrangement that allows easy shifting of belts on a wood lathe with an underneath motor drive. When you step on the treadle, the cable raises the motor enough so that the belt goes slack. The set-up also gives you the advantage of stopping the spindle without switching off the motor.

Adjust the motor-board spring so that the belt is fairly tight while in operating position without the full weight of the motor being suspended from the lathe spindle.—*L. F. Bjorklund, Croton Falls, N. Y.*



Extinguisher Smothers Fire

A NEW home fire extinguisher contains carbon dioxide packed under 850 lb. pressure. When you turn the nozzle, it emits a rush of snow-like, solidified carbon dioxide that quickly smothers grease, electrical, and other fires that water won't control. Called Fyre-Freez®, it's a product of Walter Kidde & Co., New York.

1320

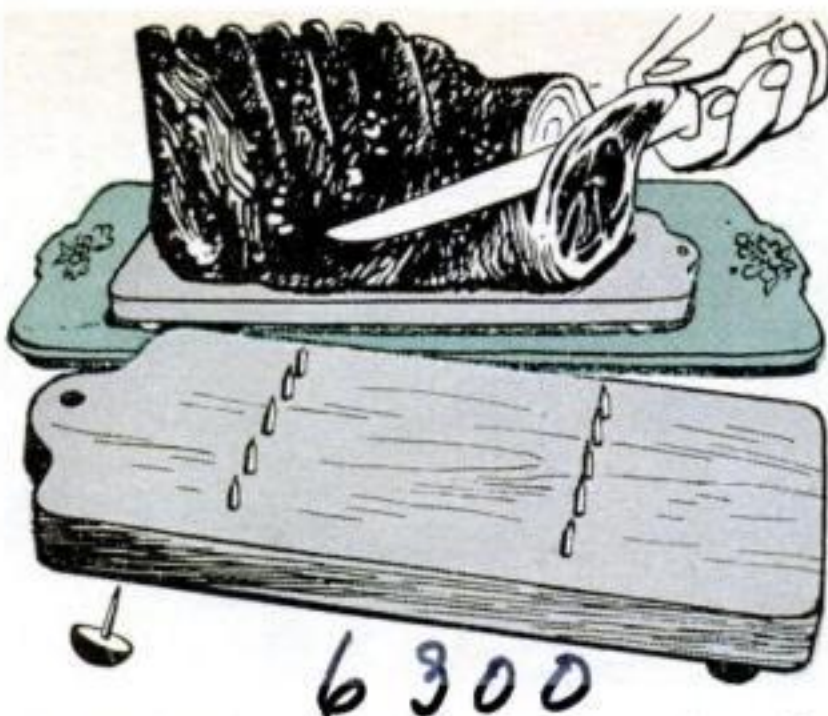
6319

DECEMBER 1948 213

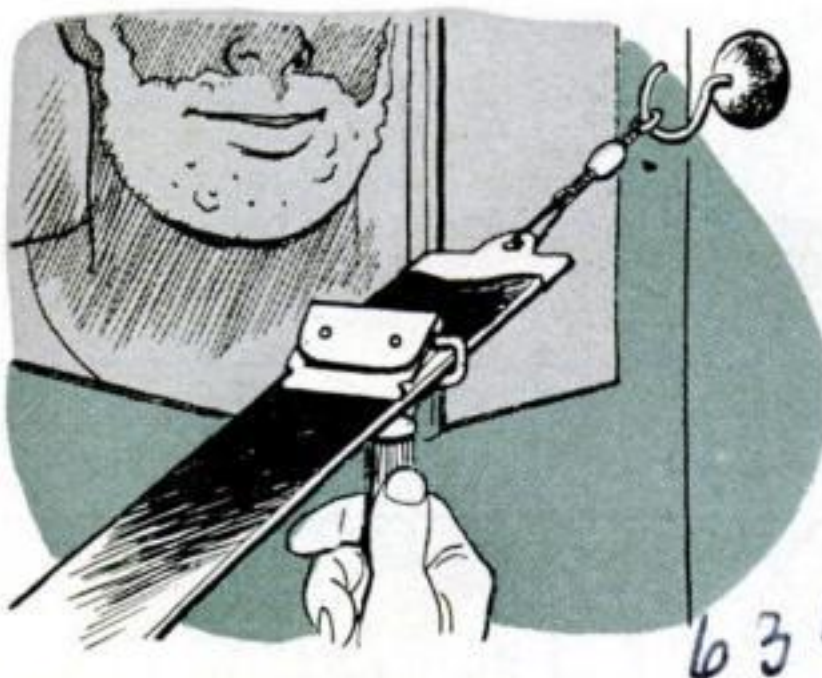
Keeping the Home Shipshape



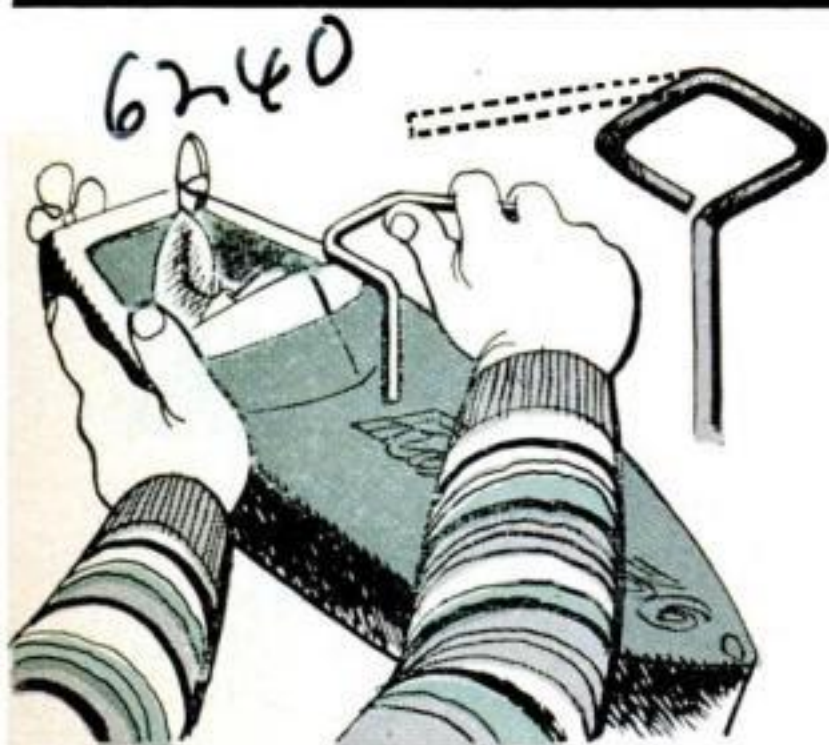
Remember to wire two or three extra sockets into your 8-bulb series-type Christmas-tree lights. All the bulbs will burn a bit less brightly, but last many times longer.



A carving board with nails driven through it from beneath will securely hold a roast or ham for slicing. Rubber feet will keep the board from slipping on the platter.



Wire a fishing-tackle swivel on your razor stop. Then it will lie flat without twisting when you turn it from the coarse to the fine side. A cuphook makes a good hanger.



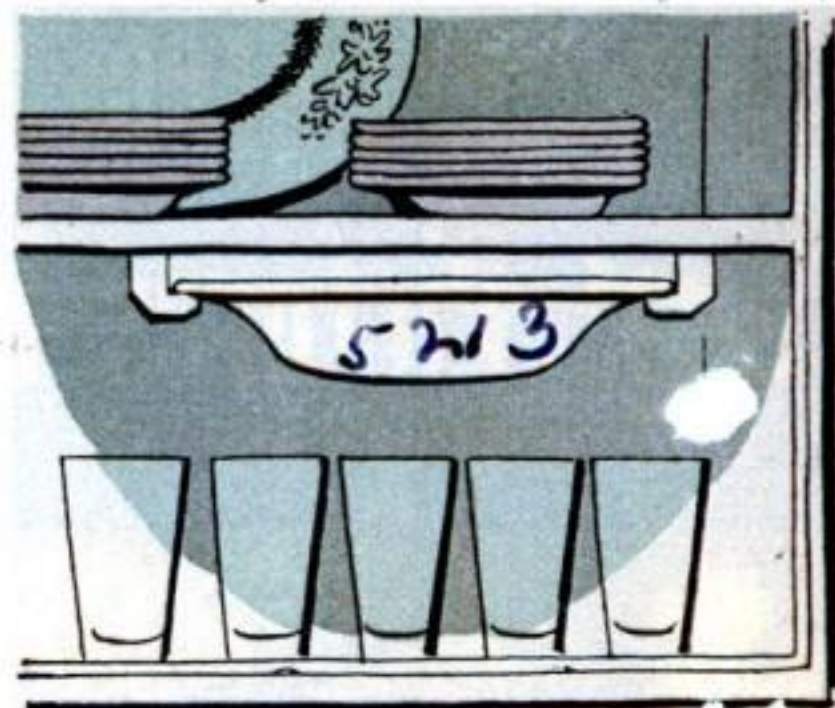
Children can wind toys more easily if one leg of the key is bent out as shown in the drawing. On rolling toys, make the change only if the bent leg will clear the ground.



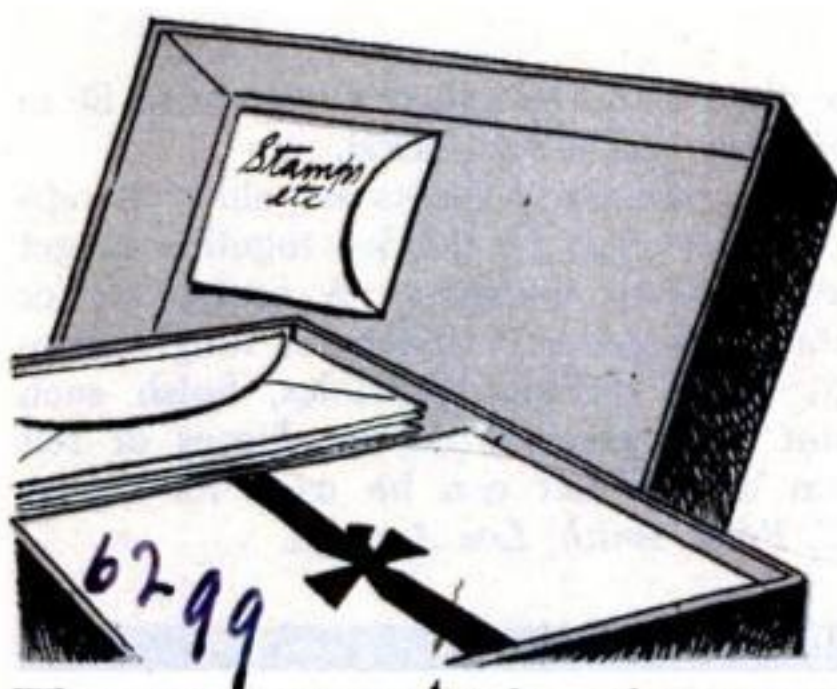
To get the shoe polish that clings to the sides of the can after the center part has been used, hold the can over a low heat. The wax will melt and form a new cake.



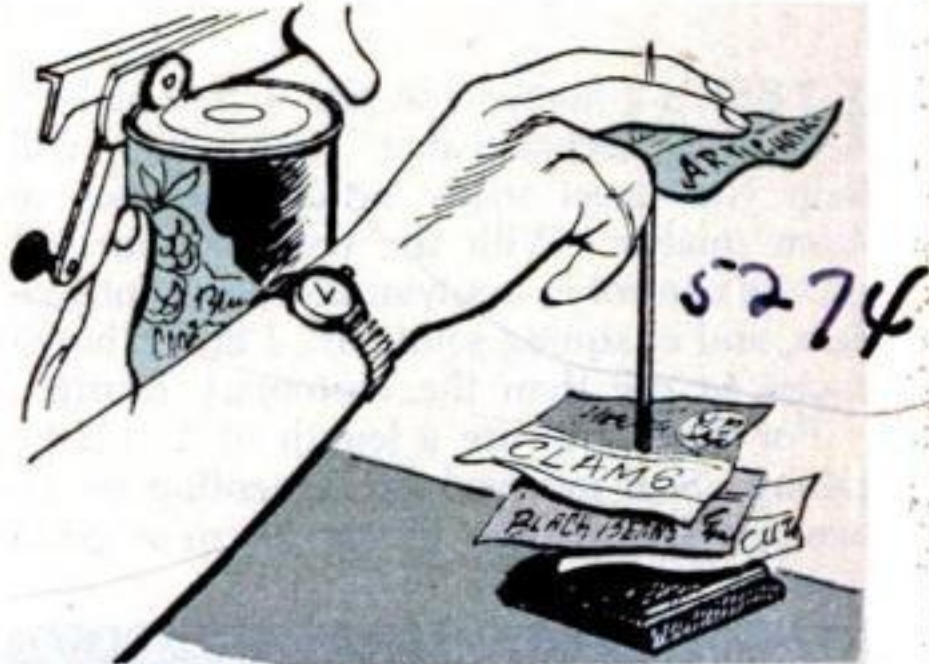
Fine tea particles won't find their way into your cup if you mount a piece of screening on thumbtacks in the canister. Dust and stem fragments will sift through it; leaves won't.



Two pieces of molding under a store a vegetable dish and save kitchen space. Nail on the molding from below. The rabbet holds the dish.



When you open a new box of stationery, paste a small envelope to the inside of the lid. Use it to hold stamps and airmail stickers, and you'll have them handy as needed.



Labels of containers—especially items you don't buy often—are good shopping reminders. Tear them off as you use the food and save on a spike until you go to market.



Half of an old hollow rubber ball, stuck over the spout of a watering can, will catch

the drips that dribble down the outside of the spout when watering potted plants in the house.

Plastic Retouching Tools

Spot Pictures Right



...dies with India ink indicate how you can use this homemade plastic pen for opaquing or

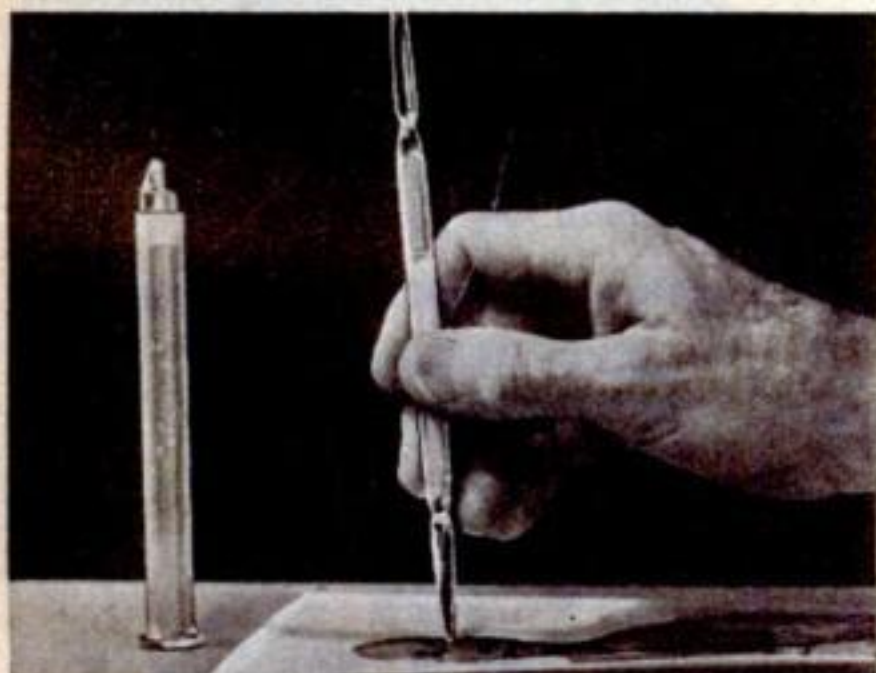
other photographic work. Interchangeable points press into barrel. One above has a narrow wick.

HERE'S a homemade plastic pen and set of interchangeable points that will help you boost many ordinary photos to salon quality. With the pen you can get precise control in applying reducers, intensifiers, and opaquing solutions. I find it much easier to use than the customary brushes.

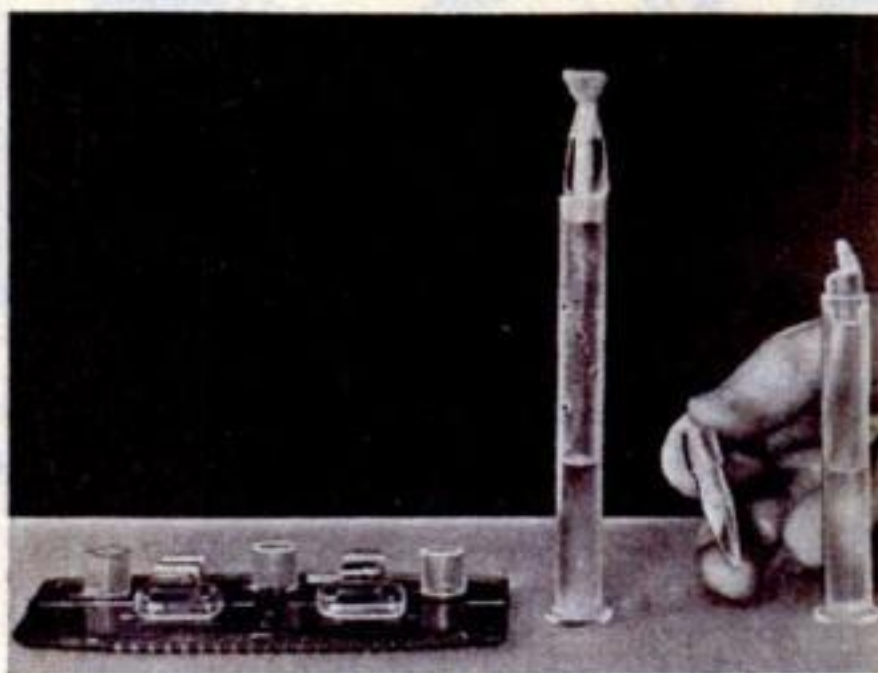
For the barrel use a length of $\frac{1}{2}$ " plastic tubing. Seal one end by cementing on an oversize disk of sheet plastic. Turn or grind

the shanks of the points for a press fit in the other end of the barrel.

Shape the set of points as below. Scraps of $\frac{1}{4}$ " sheet may be bonded together to get the necessary thickness. A coarse file or abrasive paper will suffice for rough shaping. After drilling the holes, finish each point to a graceful curve. Pieces of felt from an old hat can be used for wicks. —E. Peter Smith, Los Angeles.



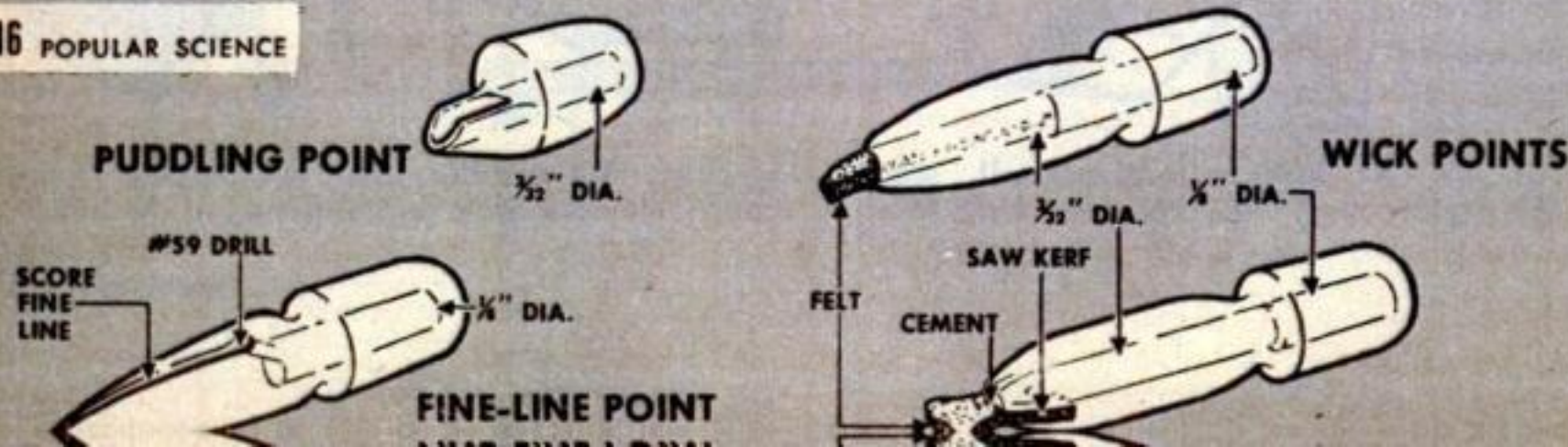
A large base allows pen to rest upright. Above is another handy tool—a piece of solid plastic pointed at one end, spade-shaped at the other, for spotting on small amounts of chemicals.



Different points (see above and below) offer you a choice for intensifying, reducing, and other work on a negative or print. While not in use, points are kept on plastic tray shown.

In making the points, dimensions are not critical but the plastic must have a smooth finish.

216 POPULAR SCIENCE



In this War... 6-watt bulbs may be used with 6-volt bulbs

Color Photo 5461

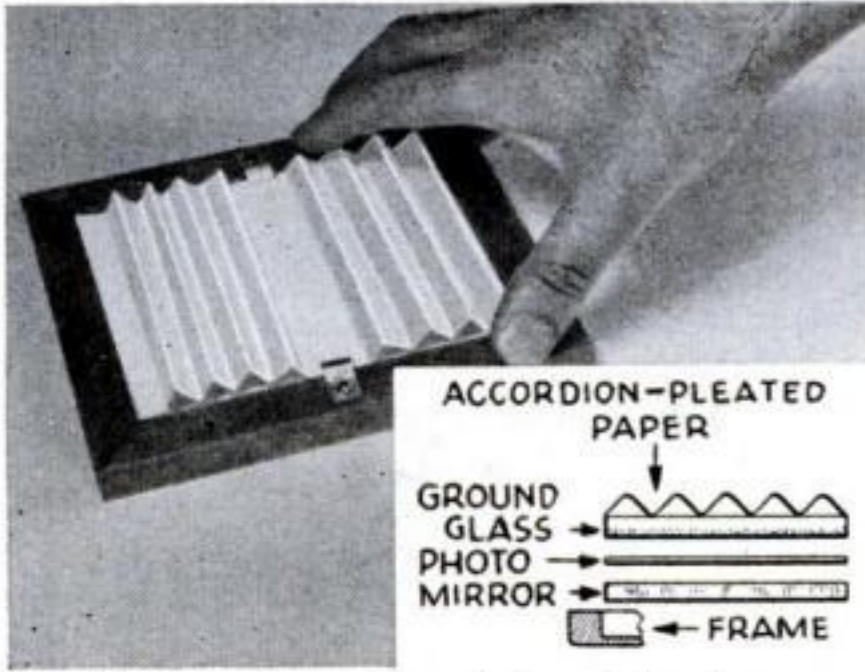
Lights Up in Mirror



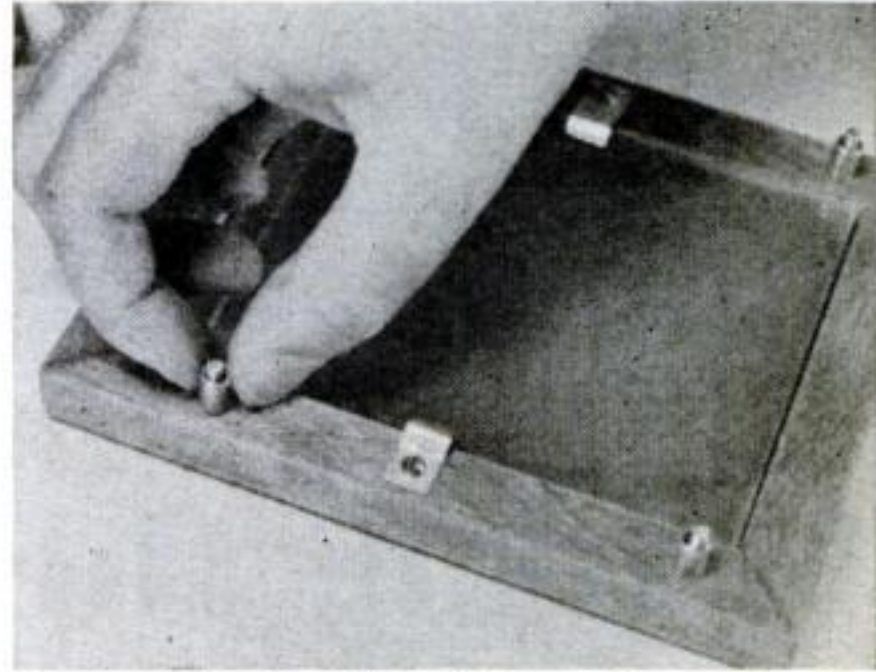
With its light on, it's a novel photo frame. Click the light out and it becomes a mirror.

NOW you see it, now you don't! It looks like an ordinary mirror until you push the button. Then it lights up and a photo appears in place of the mirror. The trick is a transparent two-way mirror, which you can buy at a glass supply house, with a color transparency behind it.

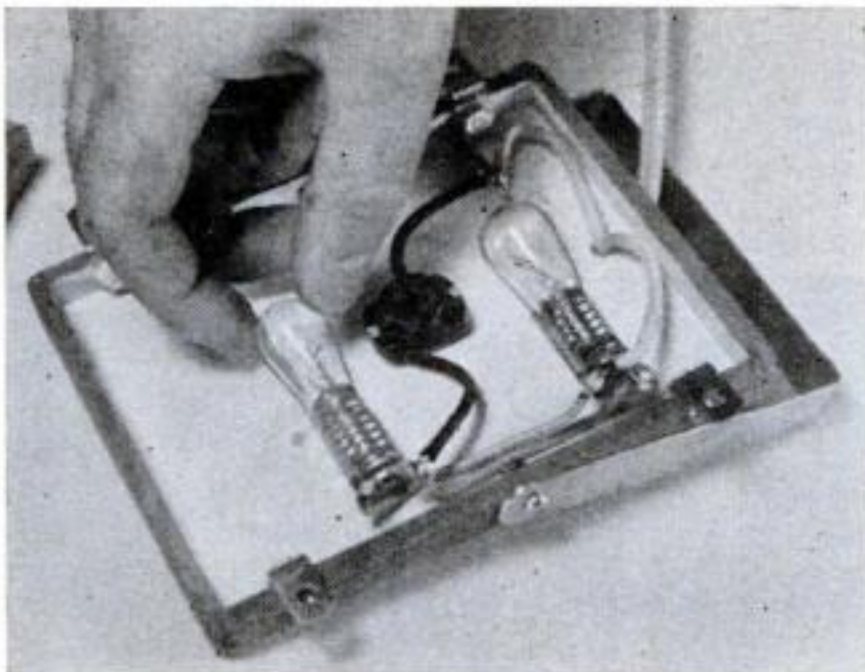
The film is sandwiched between the back of the mirror and a piece of ground glass. Back of that is accordion-pleated paper. The glass and paper diffuse the light from two 6-watt bulbs. Two cable clamps attached to the frame hold the mirror, film, ground glass, and paper. Screws and angle irons hold the back.—A. Miller, Manhattan, N. Y.



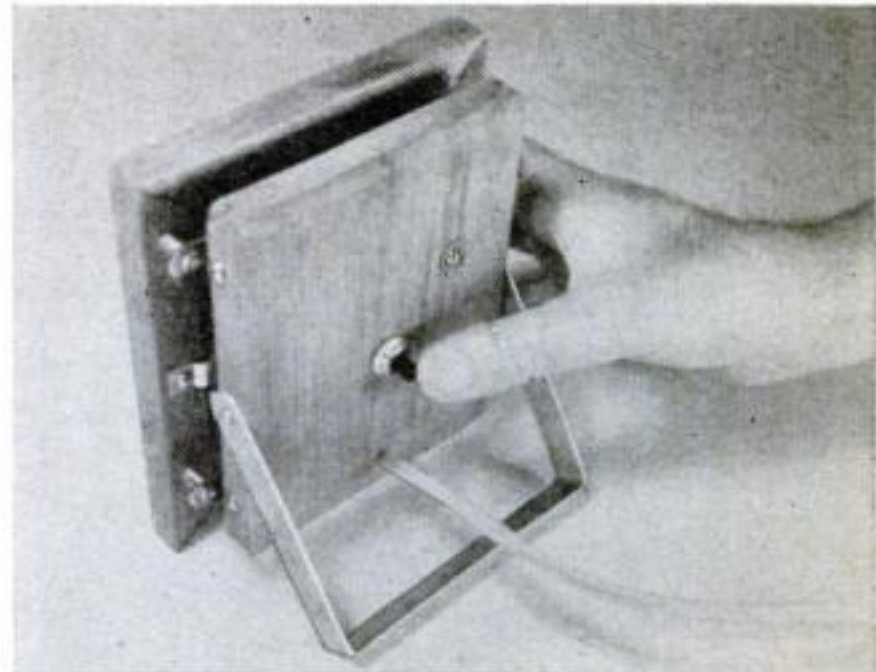
Here's how the parts of the trick mirror are assembled. Cable clamps hold parts to frame.



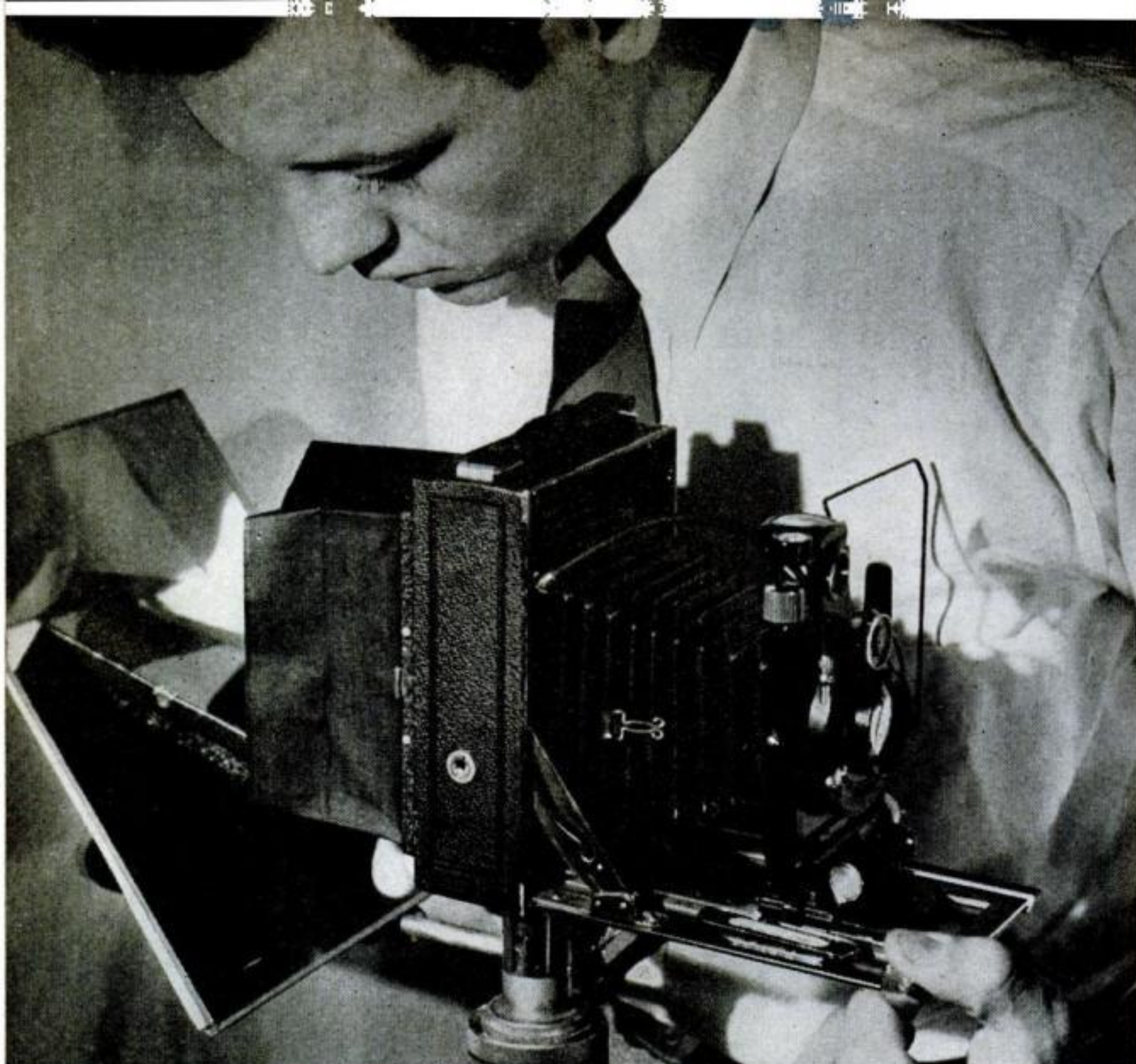
For ventilation, four 3/8" metal spacers are mounted between the frame and angle brackets.



Give the interior of back a coat of flat white paint before installing the two 6-watt bulbs.



Canopy switch and 3/8" wide adjustable support of sheet brass are mounted on back of the frame.



If you're against a wall to get distance from your subject, tilt a mirror behind the ground

glass to focus. A tilted mirror is handy at other times if you want to view image right side up.

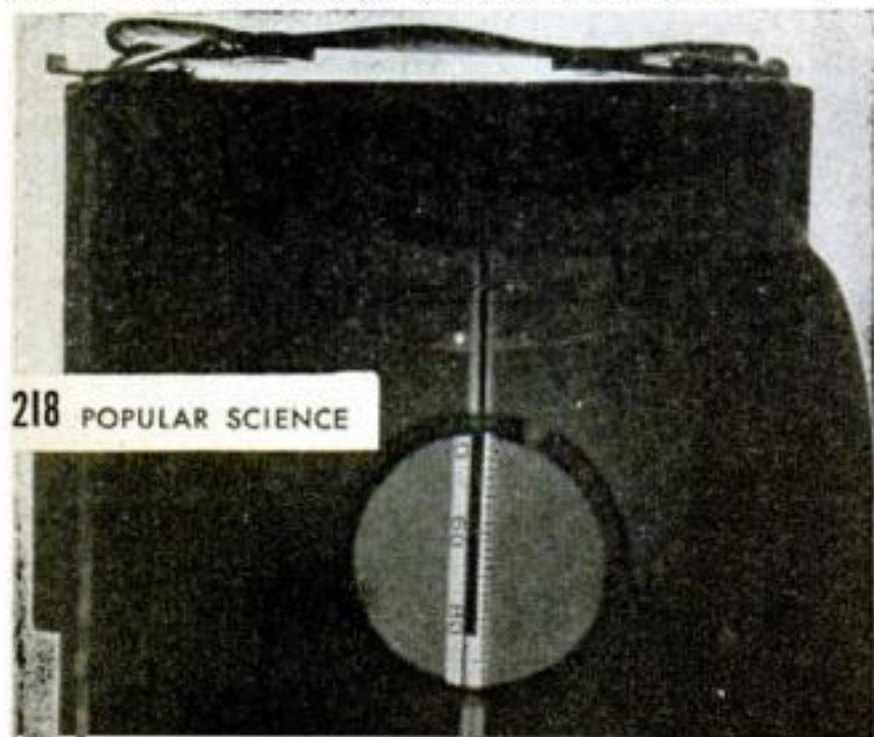
Getting the Most from Your Ground Glass

6262

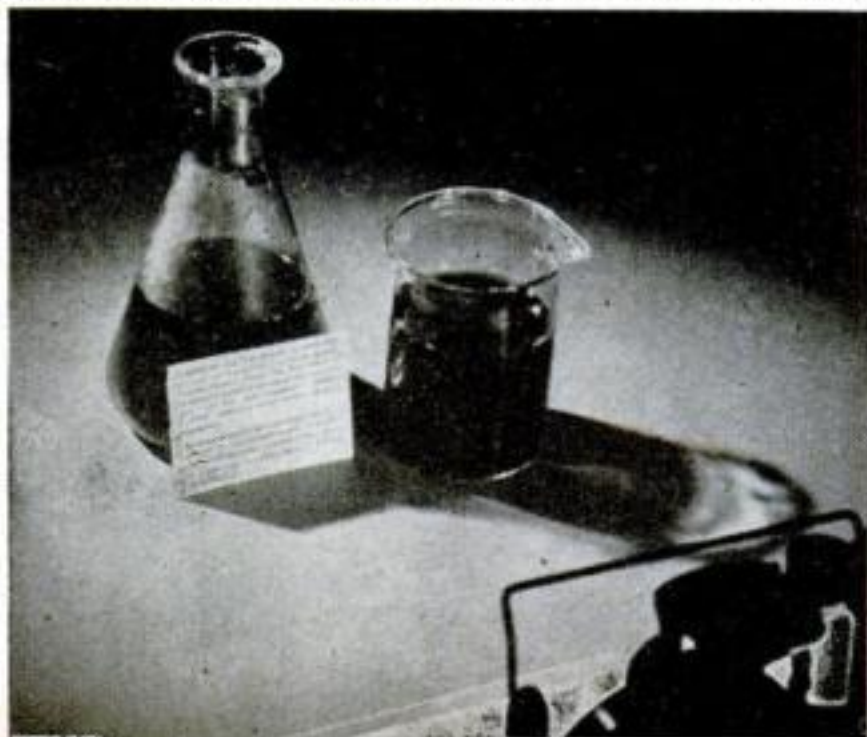
R.M. Swezey

For sharp focusing, especially when you want to shoot without stopping down too much, use a hand magnifier. This not only increases the image size but apparently gives better illumination. A dime-store glass is all you need.

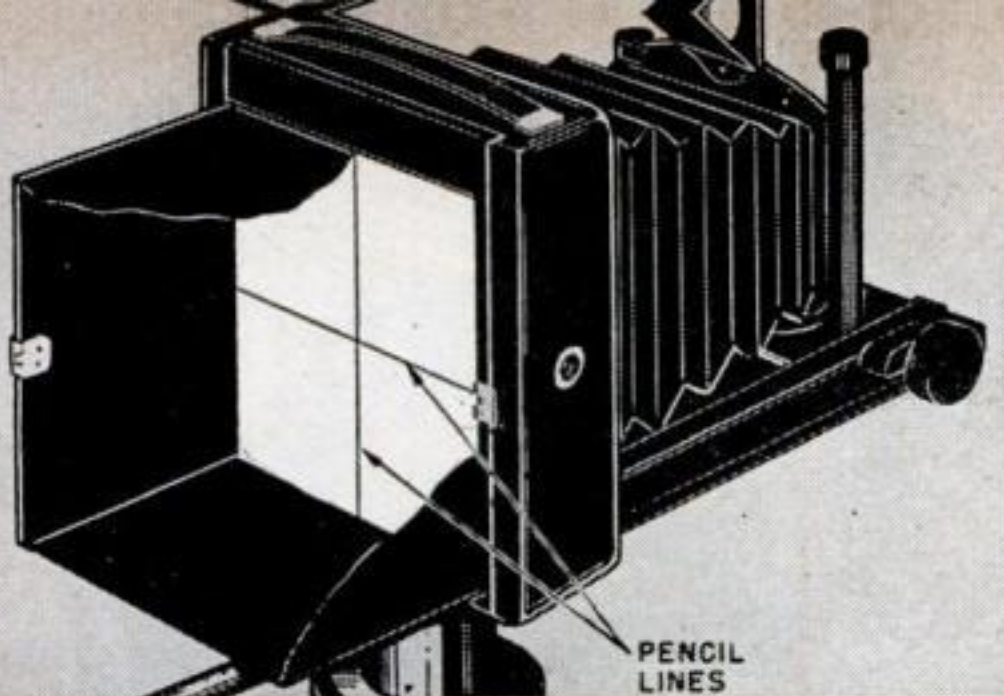
Set up a focusing target if there are no sharp details in the subject. If the target is a bit of reading matter, you may prefer to place it upside down. Stand it about a third of the way back among the objects that you want in focus.



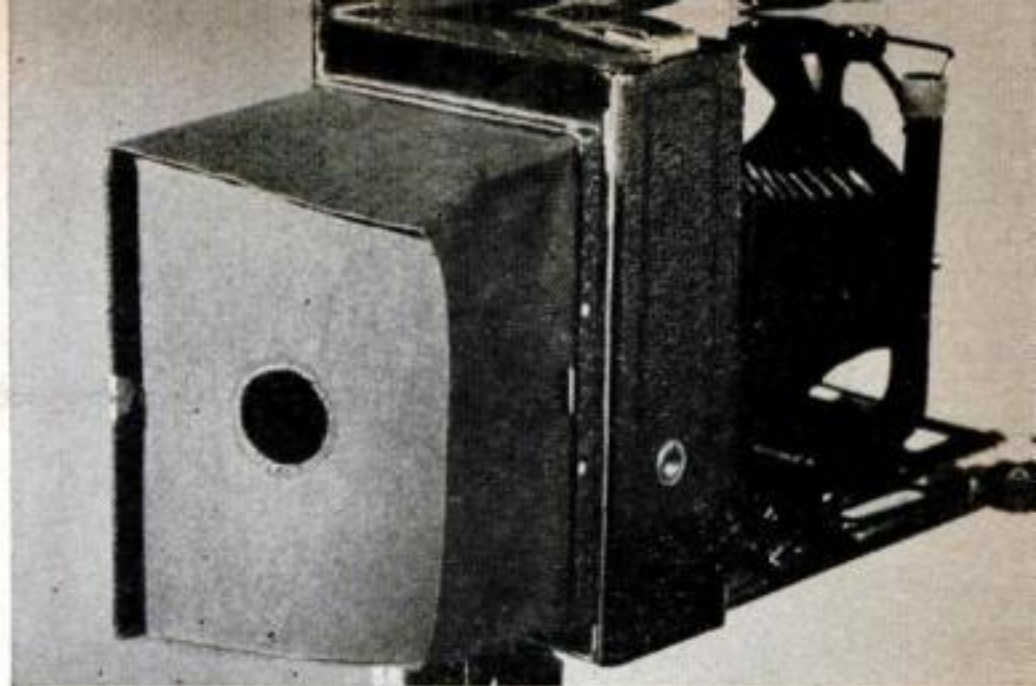
218 POPULAR SCIENCE



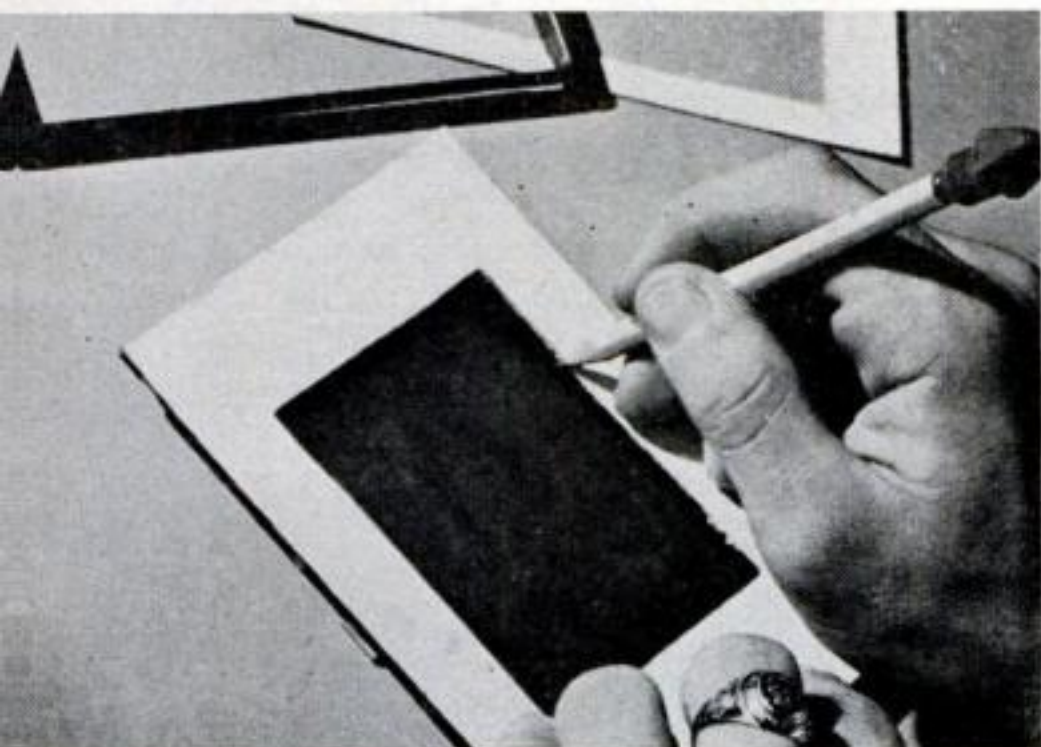
Copyrighted material



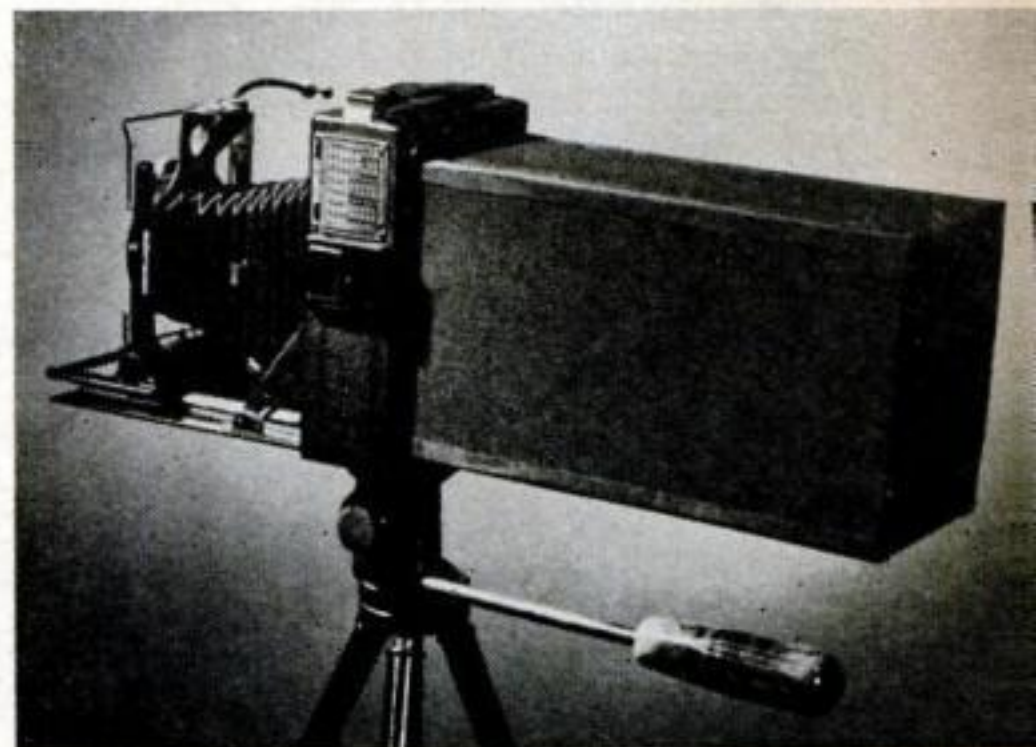
Light pencil lines dividing the ground glass into four equal parts will help you improve composition. Normally, the center of interest should be kept in one, or perhaps two, of the quarters. Lines also help keep camera level.



A focusing peephole gives you a clear view of the image when you're working in bright light. Cut black cardboard to fit snugly in the hood and center a 1" hole in it. If desired, this may be hinged to fold flat with the hood.

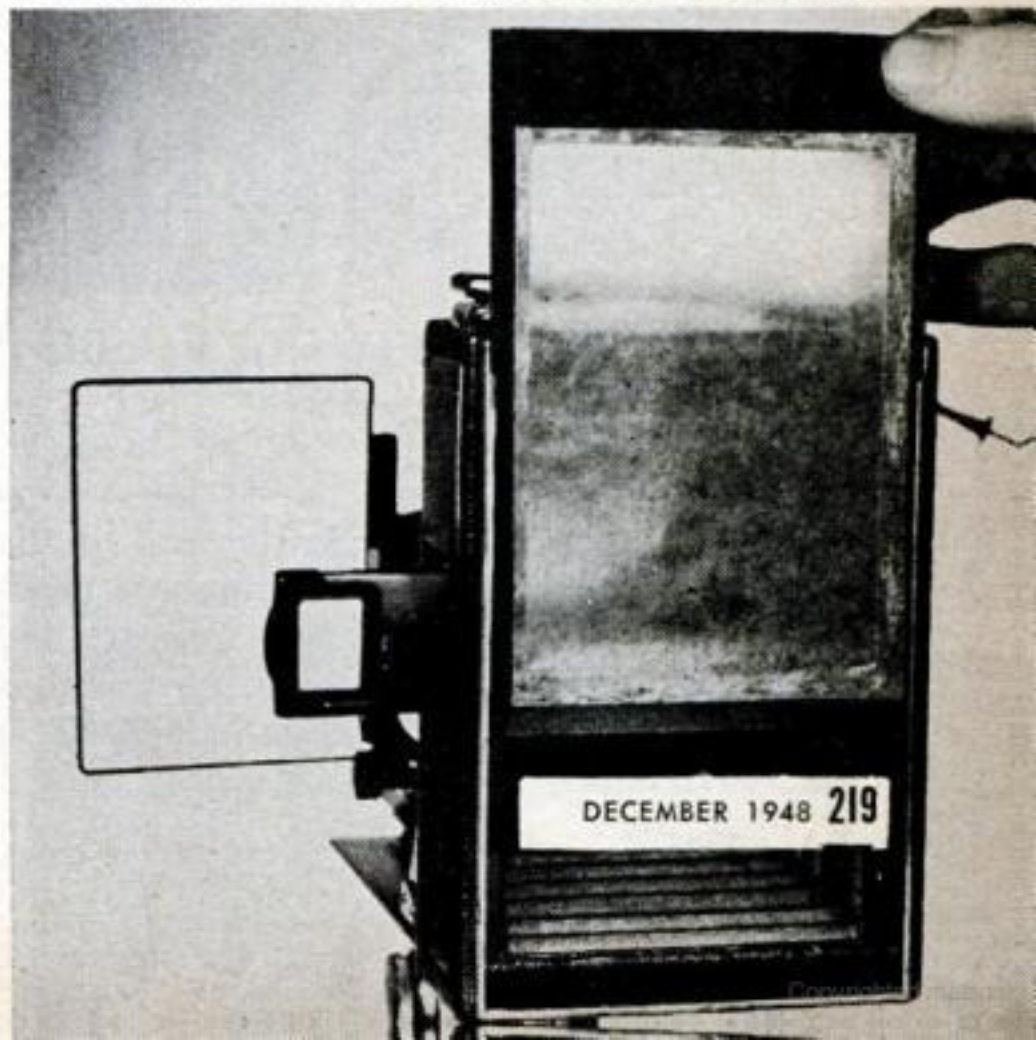


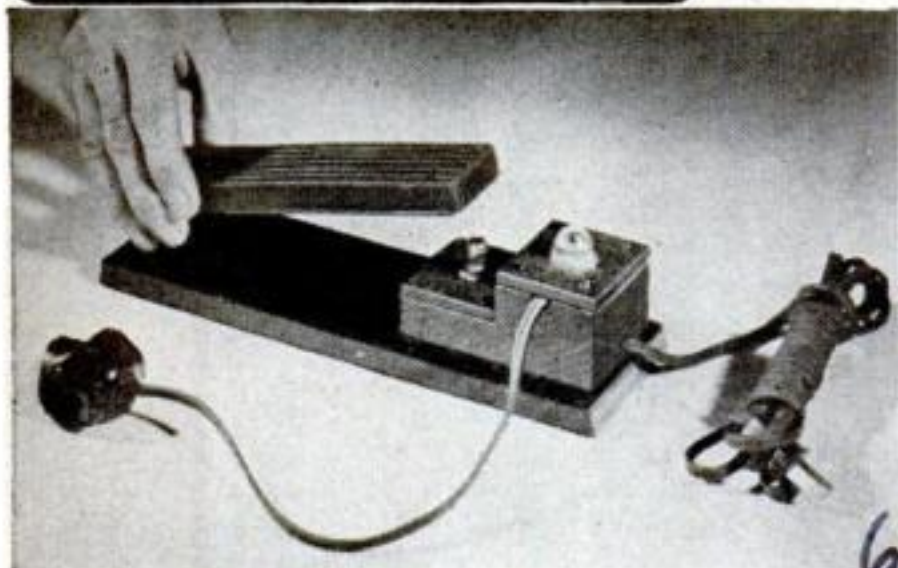
Outline the negative area on the ground glass if you use smaller than standard film in your plate-back camera. A cardboard template is a good way of doing this. A mask cut from black paper also might be placed on the glass.



An extension hood made from black cardboard may be substituted for a focusing cloth. Black tape holds the corners and allows the device to fold flat when not in use. Make it just big enough to fit easily over the regular hood.

A spot of oil dabbed on the ground surface of the glass is a trick to remember if the light is so dim you have trouble focusing. The oil lets more light through. It's effective, however, only directly behind the lens opening.





Homemade Foot Switch. With a 50-cent accelerator pedal, a neon glow lamp, and a sturdy 115-volt push switch, you can make a handy darkroom accessory. A piece of $\frac{1}{2}$ " by 3" by 10" wood forms the base, while the 2" by 3½" stepped block was sawed from a two-by-four. The bulb bracket and the push switch, mounted on two 1¼" by 2" pieces of plywood, fit into recesses in the stepped block. At right, the

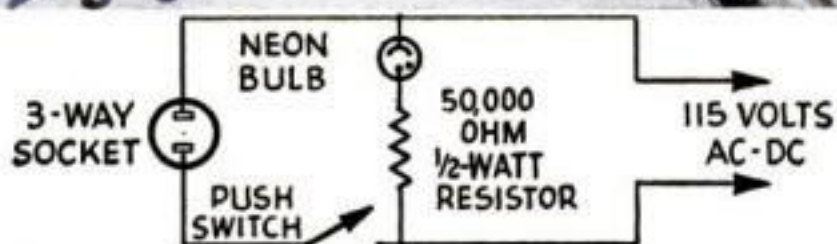
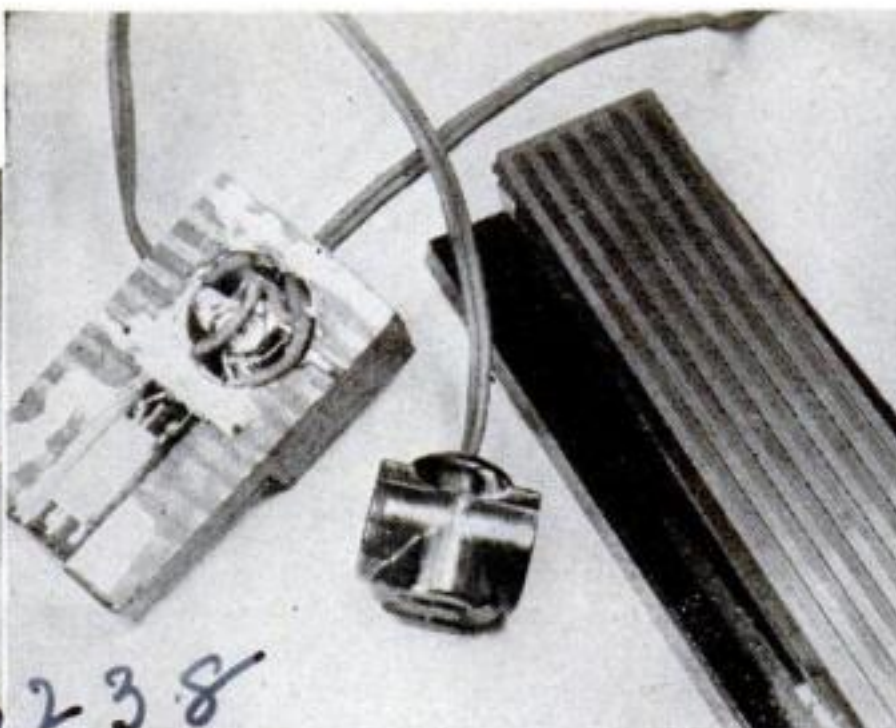
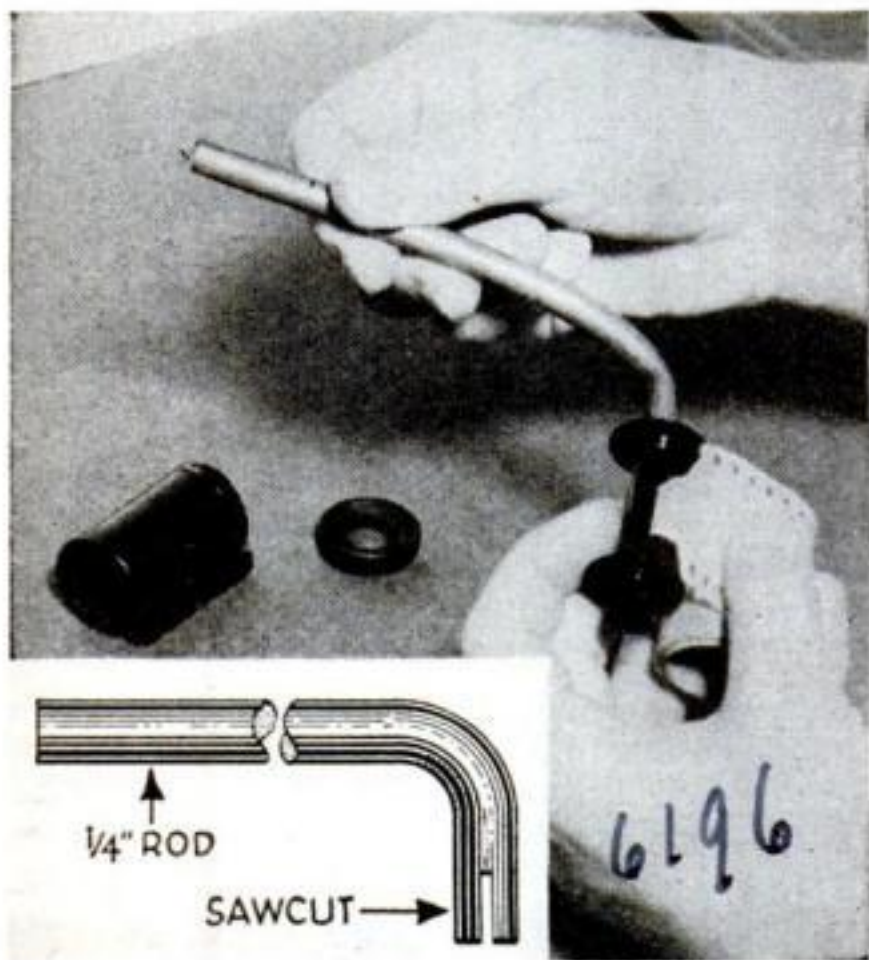
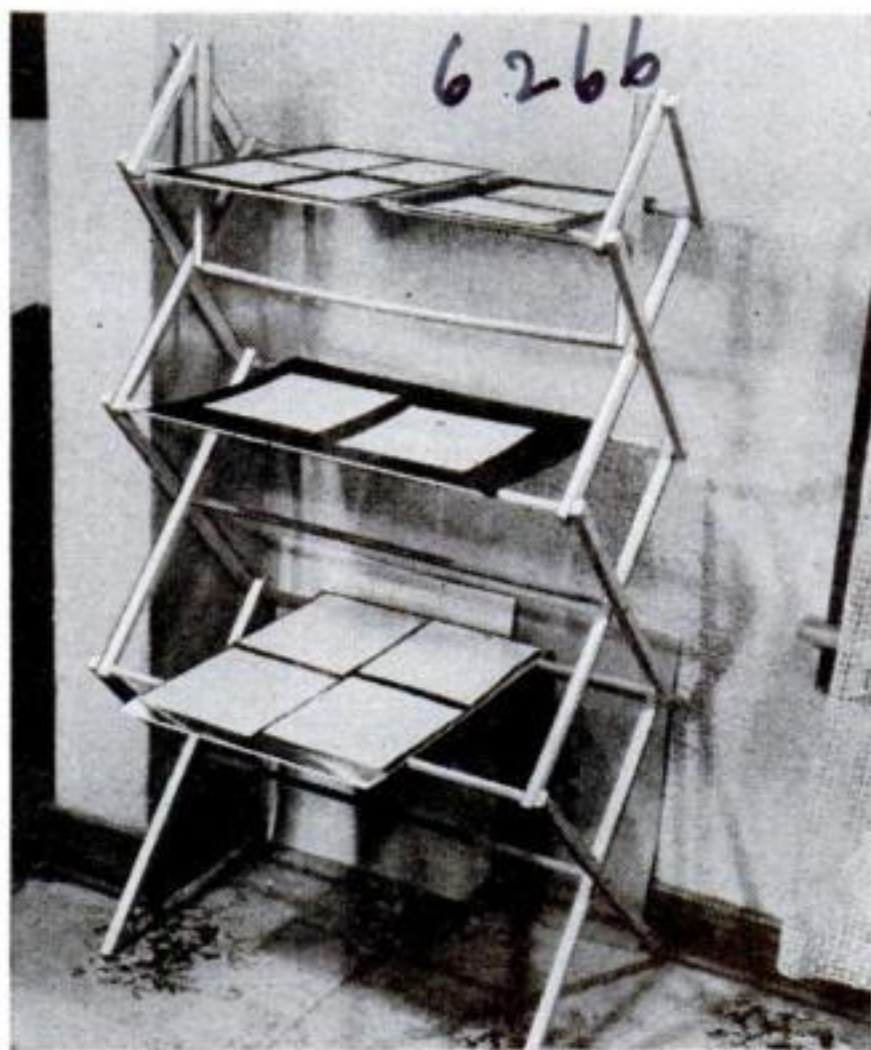


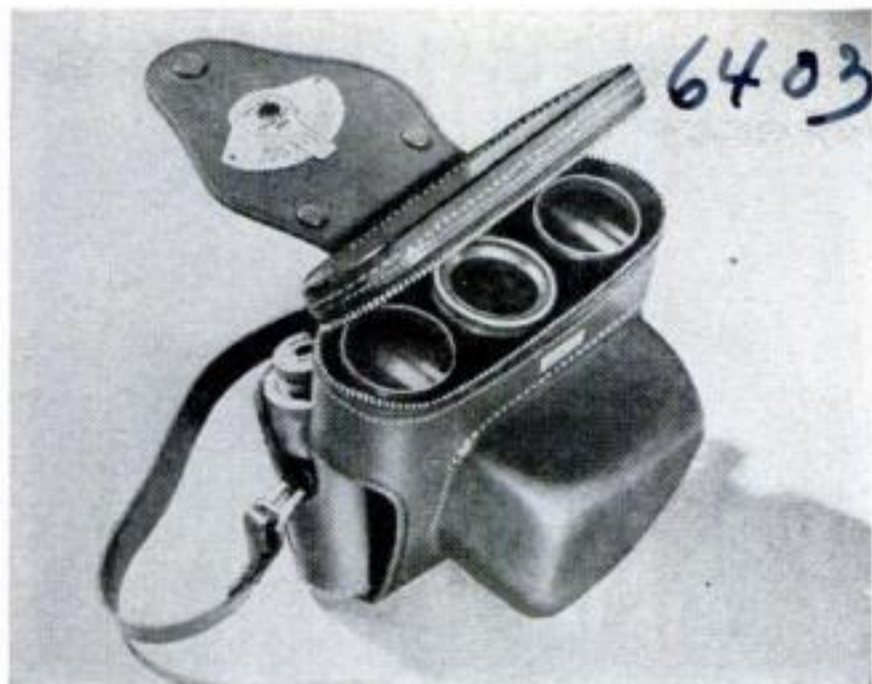
diagram shows a 50,000-ohm resistor needed with a type NE51 glow lamp; other neon bulbs may not require an external resistor. Purpose of the glow lamp, of course, is to let you locate the switch in the dark.



Wrench Locks Film in Spool. A $\frac{1}{4}$ " rod or tube makes a simple wrench for reloading 35 mm. spools that are made of two telescoping pieces. Bend the rod as shown and saw a $\frac{1}{4}$ " slot in the end of the short leg. The slot engages a flattened piece inside the spool. A short turn releases the tongue of old film. When the new film is inserted, another fractional turn locks it in place.—Harper Lyon, Topeka, Kan.



Space-Saving Dryer. When extended, a collapsible clothes rack will support three 18" by 24" ferrotype plates or a combination of smaller plates, yet the rack takes up very little floor space in a crowded darkroom. By tacking cloth, such as muslin, across the dowels, matte prints also can be dried.—Jim Cook, Lyons, Kan.



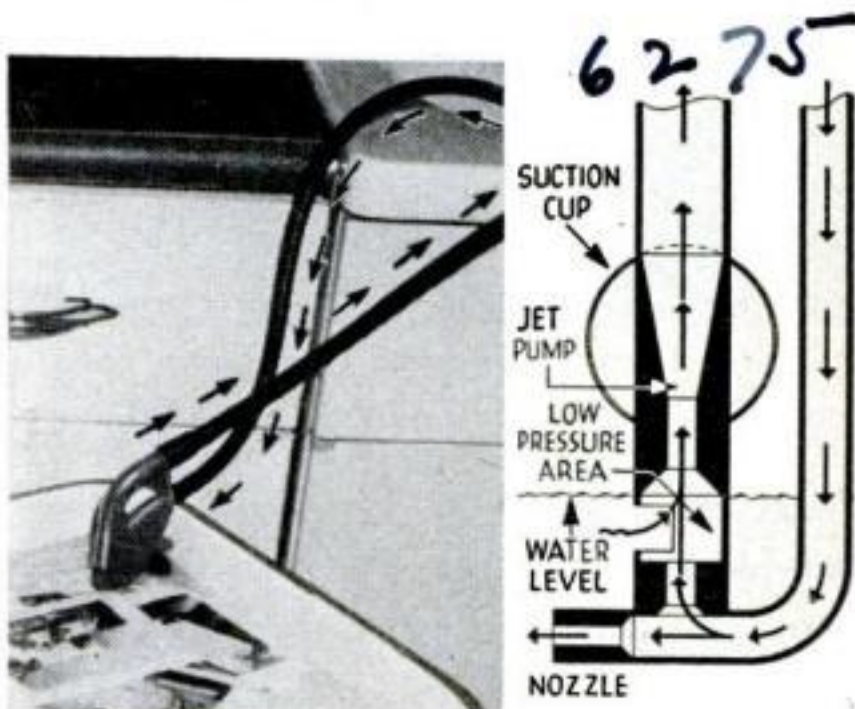
New Case Stores Filters. A compartment atop this 35 mm. case holds several filters and a lens shade. The indicator on the flap may be set at the speed of the film in the camera. It acts as a reminder of the type of film in the magazine. The maker is Diamond Case Division of Louis Lefkowitz and Bro., New Brunswick, N. J.



Notches Identify Slides. Color slides can be recognized easily in the dark for placement in the projector by notches cut or punched in one corner of the cardboard holders. The idea, similar to the nicks in cut film, can be extended by marking each subject with a different number of notches.—Emil Gaynor, Manhattan, N. Y.



New Midget Camera. Half the size of a pack of cigarettes, the Miracle Mycro ® shoots 9 mm. by 15 mm. negatives, a special film size of 10 exposures being sold only by the distributor, Mycro Camera Co., New York City. The imported camera has an f/4.5 color-corrected lens and retails at \$16.50, including a leather carrying case and strap.




Washer Elevates Discharged Water. The Hydrojet ® photo and film washer draws off enough water to maintain a constant level in the pan, even though the pan is below the level of the drain. Since the inlet nozzle is smaller than the supply line, only part of the water supply goes into the pan. The rest is forced up the outlet tube, drawing water from the pan with it. The maker is Hydrojet Corp., Trenton, Mich.



Taping Adds to Blotter Life. Photo blotters, when handled wet, usually develop ragged edges. Cellulose tape around the edges will prevent fraying and tearing, greatly extending their useful life.

Reshaping Warped Movie Reels. Distorted plastic reels, if heated cautiously over a low flame or soaked in boiling water for a few minutes, can be bent back to proper shape. Such reels are best stored with film wound on them and in a horizontal container. The number 4236 is handwritten in the top right corner.

Oscillator-Amplifier Is Your Master Music System



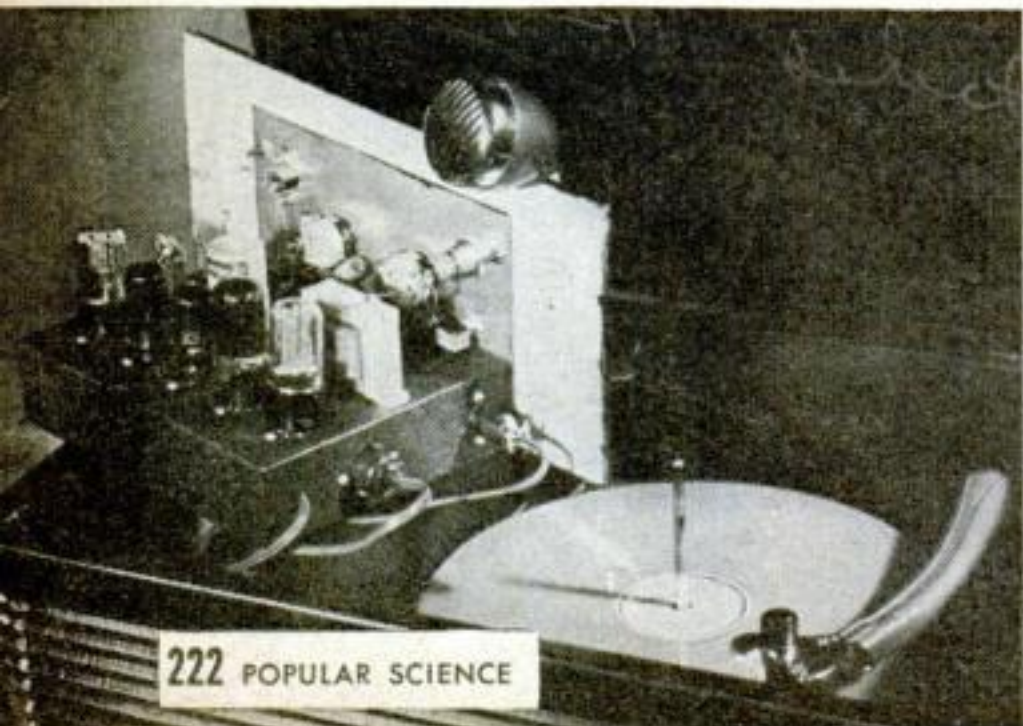
Recorded music or your own voice goes over the airwaves at the mere flick of a switch.

You can play it through its own speaker, any nearby radio, or you can combine both at the same time.

By Henry C. Martin

LARGE households can get the most out of this centralized control system that pipes music anywhere in the house, but you'll also find it handy if you have any-

Connections for speaker, phono motor, pickup, and mike are made by means of plugs and jacks.



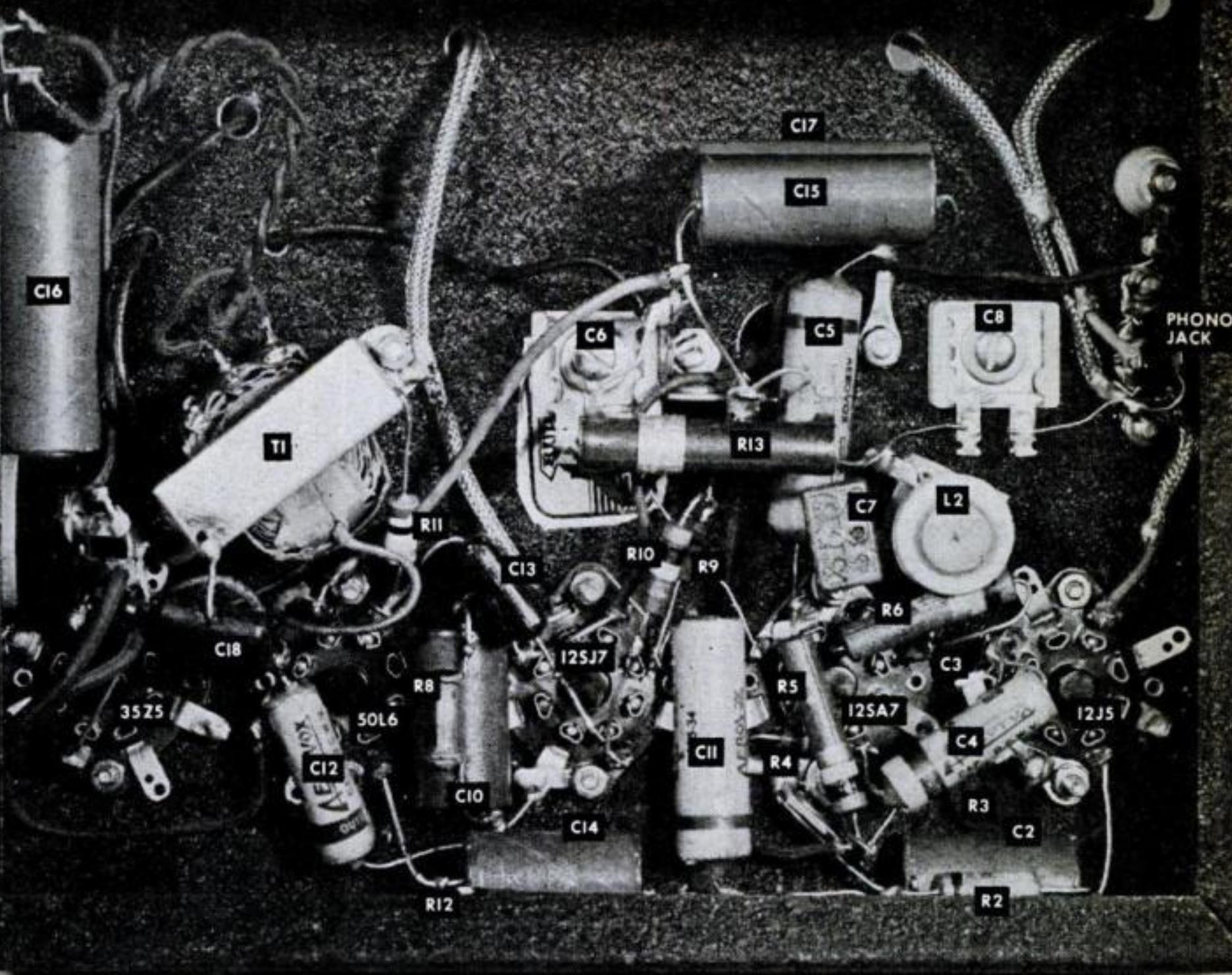
4057

thing larger than a one-room apartment. Here's a unit that combines two types of record player—a direct amplifier and an oscillator that broadcasts through any nearby radio. The features may be used together, or either one will work by itself. While your wife enjoys a stack of records in the living room, you can have the same music in your basement shop. Those little radios in the kitchen or an upstairs bedroom can also pick up the program. And if you have a few radios strategically located around the house, the microphone and oscillator become a handy one-way intercom to summon you to the telephone or to dinner. All this and a hundred other uses of your own devising are controlled from the single switch panel on your master music system.

An automatic record changer was used in this model and is recommended, but a separate motor and crystal pickup would operate just as well on a one-record-at-a-time basis. Also, if you are in an experimental

POWER
SOCKET
FOR
PHONO
MOTOR

PHONO
JACK



Although there is ample room on both sides of the chassis, parts should be closely grouped.

mood, you can ring in such changes as installing a 33 $\frac{1}{2}$ r.p.m. turntable with a special lightweight pickup for the new long-playing records, or you can add a magnetic pickup and preamplifier by adapting the circuit shown on page 227.

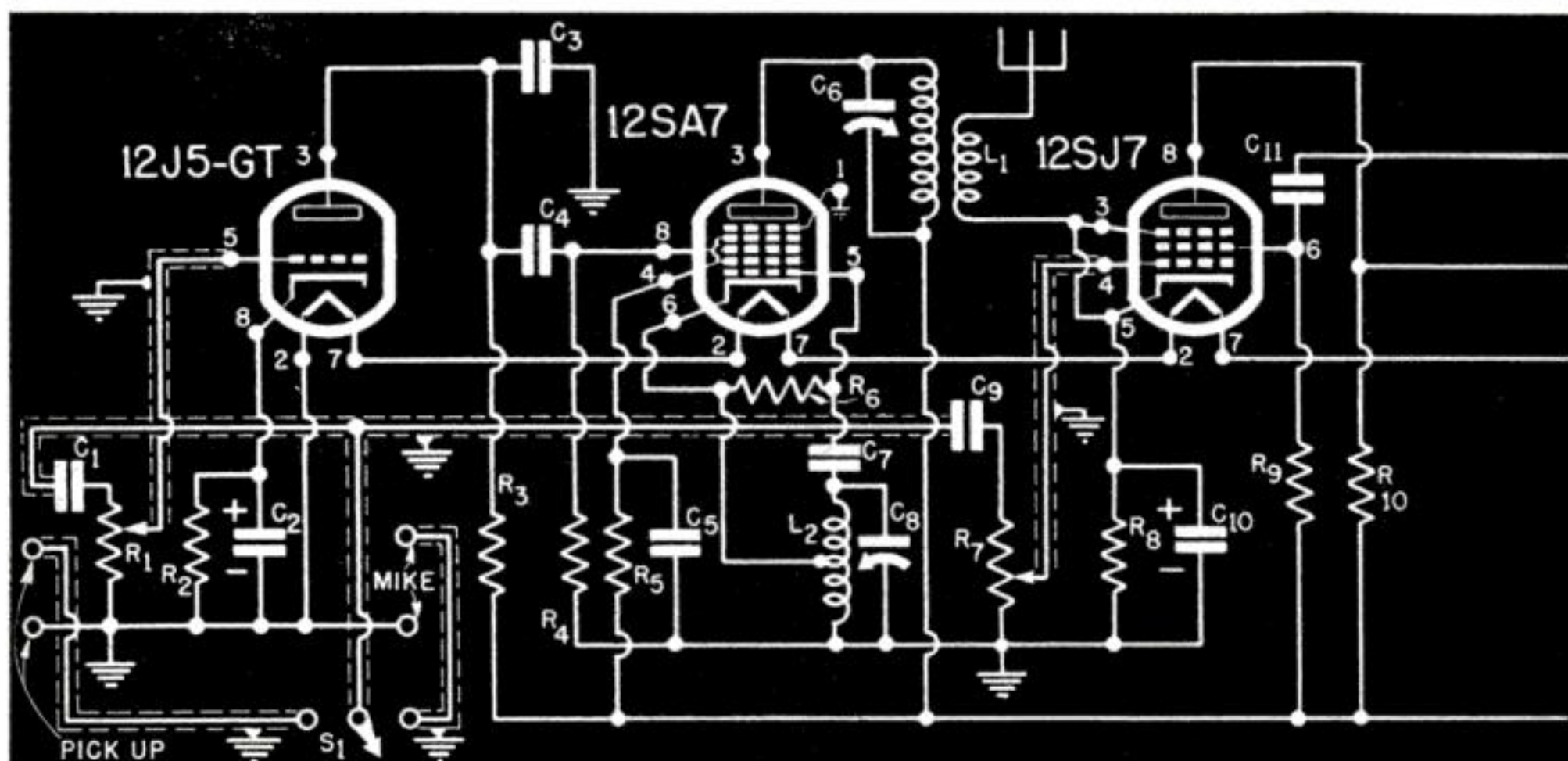
In all cases the basic oscillator-amplifier circuit remains the same. It is built around five tubes. Two of them (the 12J5 and 12SA7) are used in the oscillator section to broadcast sound from the microphone or pickup; two more (the 12SJ7 and 50L6) amplify the same signal and feed it out—on demand—through the built-in speaker. The fifth tube, a 35Z5, rectifies the AC power and supplies the required DC voltages to the other four stages.

With a 5-meg. variable resistor (R1) acting as a volume control in the oscillator part, you can "ride the gain" on the transmitter. Volume can also be regulated at the receiving set. A separate potentiometer, R7, controls the volume of the two-tube audio amplifier.

Both the antenna and oscillator coils are tuned by means of small ceramic padder condensers (C6 and C8); one is mounted on the chassis on each side of the shielded antenna coil (L1). The padder that tunes this coil is connected across the larger of the two windings—usually considered as the secondary. A tapped coil, L2, in this electron-coupled oscillator circuit, is tuned by

The chassis is bolted to a metal panel which, in turn, is inset into a larger wooden front.





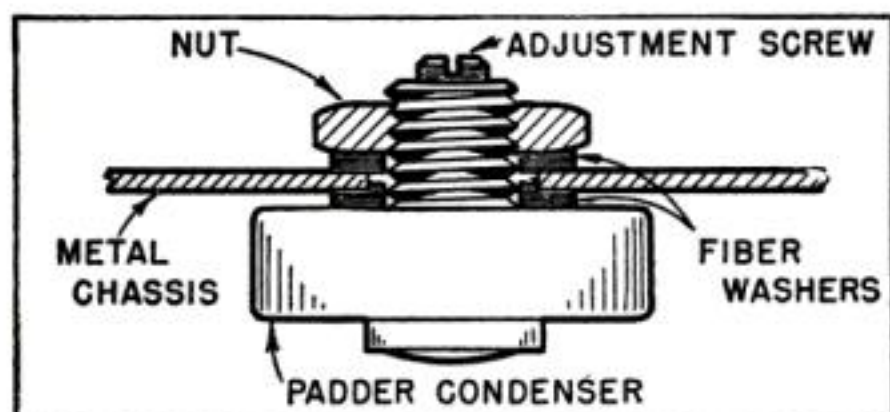
the second padder. Once the padders have been correctly set (by means of a small screwdriver adjustment) they should need no further attention unless you decide to change the frequency of the little transmitter. It is important to insulate both padders from the chassis; this can be done by means of fiber washers as shown in the drawing below. The bottom washer should have a slight shoulder to make the insulation positive and prevent the shaft from sliding sideways into contact with the metal.

As can be seen in the photos, the standard 2" by 7" by 9" chassis that was used is more than ample for all the necessary parts. It can be made smaller, but since the chassis takes a relatively small portion of the total space in any phonograph, the saving will not be great. Five octal sockets for the tubes are mounted in a line along the rear of the chassis. The filter choke and antenna coil are placed in front of the tubes, and padder condensers peer up from underneath on both sides of L1. Almost directly underneath the

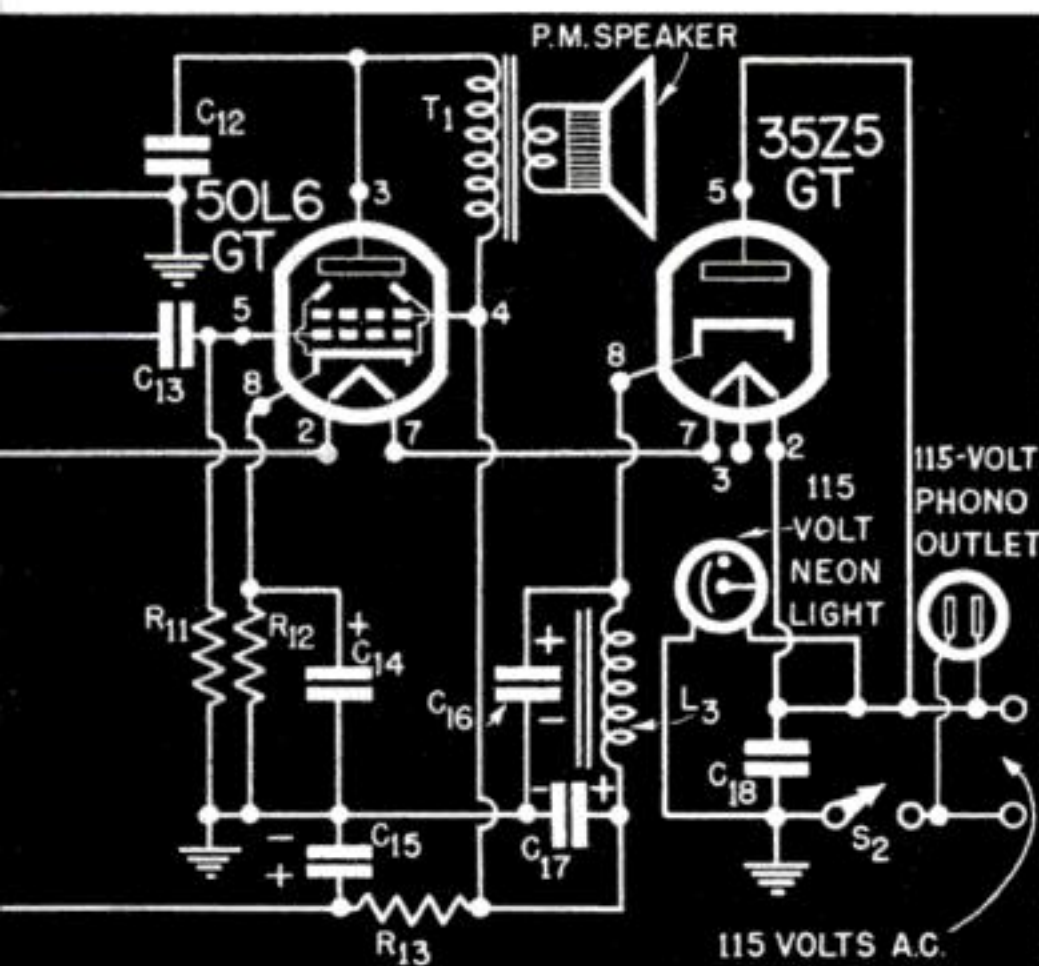
choke and at right angles to it is a small universal output transformer. The photo of the underside of the chassis shows two leads coming from the secondary of this transformer and terminating at a recessed two-connection socket in the side of the chassis. This was done for convenience in assembling the unit in a cabinet. The two leads coming from the voice coil of the speaker plug into the socket and can readily be disconnected when the chassis has to be removed for any reason.

With the same idea of making the chassis as independent as possible of external connections, all other contacts are made by jacks or sockets. This arrangement, of course, is optional with the builder. The feed-through, 115-volt line into which the phono motor can be plugged is brought to a recessed socket. This connection is tapped off the line ahead of the power switch (S2). Most automatic record changers have their own switches so they can be stopped (for changing records or when the microphone is to be used) without cutting off the current going to the oscillator-amplifier. If your changer hasn't such a switch, or if you are using a plain motor, insert a SPST switch in series with one side of the motor's line cord.

A two-connection jack on the chassis receives the "hot" and grounded leads from the crystal pickup. This jack is not accessible when the unit is in a cabinet, but there's no need to get at it since switch S1 changes over the input circuit from phonograph to microphone. Because the mike need not be



The padder condensers must be insulated from the chassis. Use two fiber washers as shown.



LIST OF PARTS

- R1, R7: 5-meg. potentiometer.
 R2: 1,800-ohm, 1-watt carbon.
 R3: 68,000-ohm, $\frac{1}{2}$ -watt carbon.
 R4: 100,000-ohm, $\frac{1}{2}$ -watt carbon.
 R5, R6, R10: 51,000-ohm, $\frac{1}{2}$ -watt carbon.
 R8: 22,000-ohm, 1-watt carbon.
 R9: 1-meg., $\frac{1}{2}$ -watt carbon.
 R11: 680,000-ohm, $\frac{1}{2}$ -watt carbon.
 R12: 390-ohm, 1-watt carbon.
 R13: 1,000-ohm, 10-watt wire-wound.
 C1, C9, C13, C18: .01-mfd., 400-volt paper.
 C2: 5-mfd., 25-volt dry electrolytic.
 C3: .0002-mfd. ceramic.
 C4, C12: .006-mfd., 400-volt paper.
 C5, C11: .05-mfd., 400-volt paper.
 C6, C8: 175 to 500-mmfd. ceramic padder.
 C7: .0001-mfd. mica.
 C10, C14: 10-mfd., 25-volt dry electrolytic.
 C15, C17: 16-mfd., 150-volt dry electrolytic.
 C16: 24-mfd., 150-volt dry electrolytic.
 L1: Shielded iron-core ant. coil for broadcast band.
 L2: Tapped osc. coil, air-core, unshielded, 456 kc.
 T1: Universal output transformer.
 S1: SPDT toggle.
 S2: SPST toggle.
 P.M. speaker, 115-volt neon pilot lamp, record changer or phono motor and pickup, tubes, sockets, two-connector jacks (2) and plugs; recessed feed-through socket, misc. hardware.

a permanent part of the assembly, its jack is placed on the front panel.

In the diagram above, some of the input leads are represented as being made with shielded wire. If you trace the same portions of the circuit in the photos, you will find that some of these leads are unshielded. This was done because it was found convenient to keep these leads short, near the chassis, and out of the way of other wires. When the layout allows this you may omit the shield, but otherwise it is a good idea to provide for it.

Cabineting the oscillator-amplifier is a matter for individual taste. For convenience, a purchased cabinet designed to hold a record changer, amplifier and speaker was used in the model illustrated. Although it was relatively inexpensive, it did add about \$10 to the cost of the item—an amount you may be able to save by constructing your own cabinet or building the unit into a bookcase or other piece of furniture. Total cost, incidentally, ran to about \$45, including the cabinet and record changer but not counting a microphone. This changer cost something over \$20. Other models are available at half or twice this price. Since the components are all standard, your spare-parts box may make a big dent in the cost figure.

When you have completed and double checked the wiring, connect the speaker, phono motor, and pickup, turn on S2 and throw S1 to "phono" position. Give the amplifier a few seconds to warm up, then check for sound by scraping a finger across

the pickup needle. There are no tuning adjustments to be made on the amplifier section.

In order to transmit, however, you must first align the oscillator padders. Tune a nearby radio to a dead spot near the *low* end of the broadcast band—around 600 kc. on the dial. Adjust the padder across the oscillator coil first. This one is critical and should be tuned by turning the setscrew slowly until the test signal is heard on the radio. For a test signal you can either continue the needle scraping or play some records with the amplifier volume turned way down.

When you have the oscillator padder set to its best position, adjust C6 for maximum volume. Once the signal starts coming through the radio receiver, lower the volume adjustment (R1) to keep from overloading the transmitter and distorting the sound. Keep this resistor at about the half-way setting for the phonograph but turn it up for the mike. When either the oscillator or amplifier is wanted by itself, set the control of the other all the way down.

This two-tube oscillator has a husky output and with a long antenna is capable of radiating signals further than the maximum allowed by the Federal Communications Commission. To avoid trouble, keep the antenna short. A 5' or 6' piece of insulated copper wire left dangling behind the cabinet should be adequate.

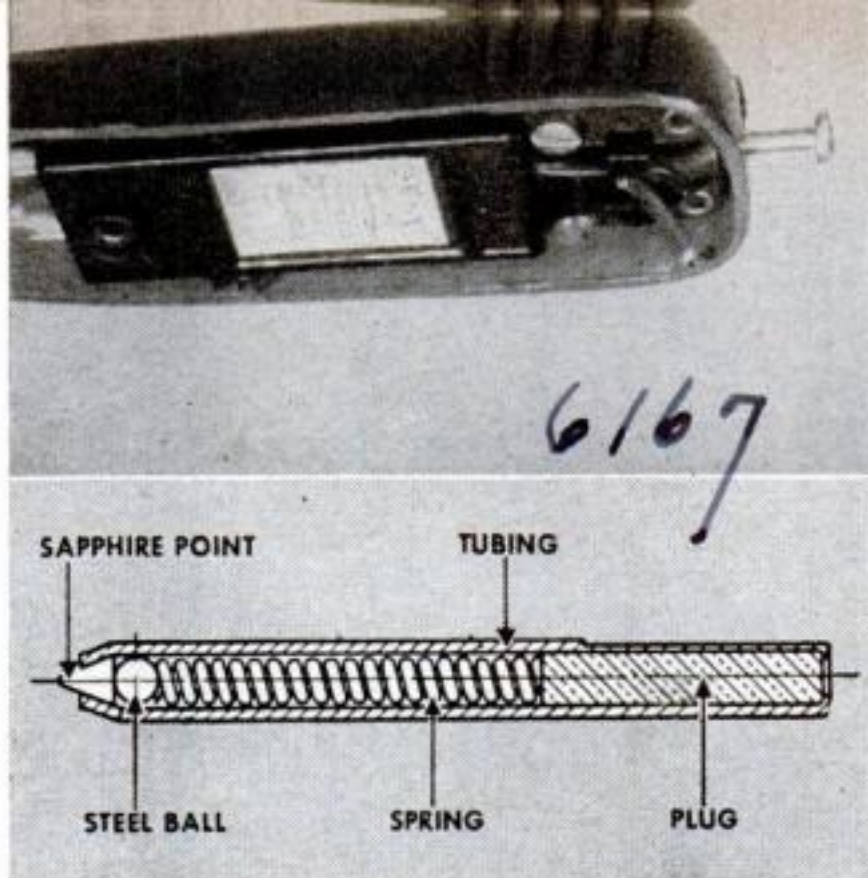
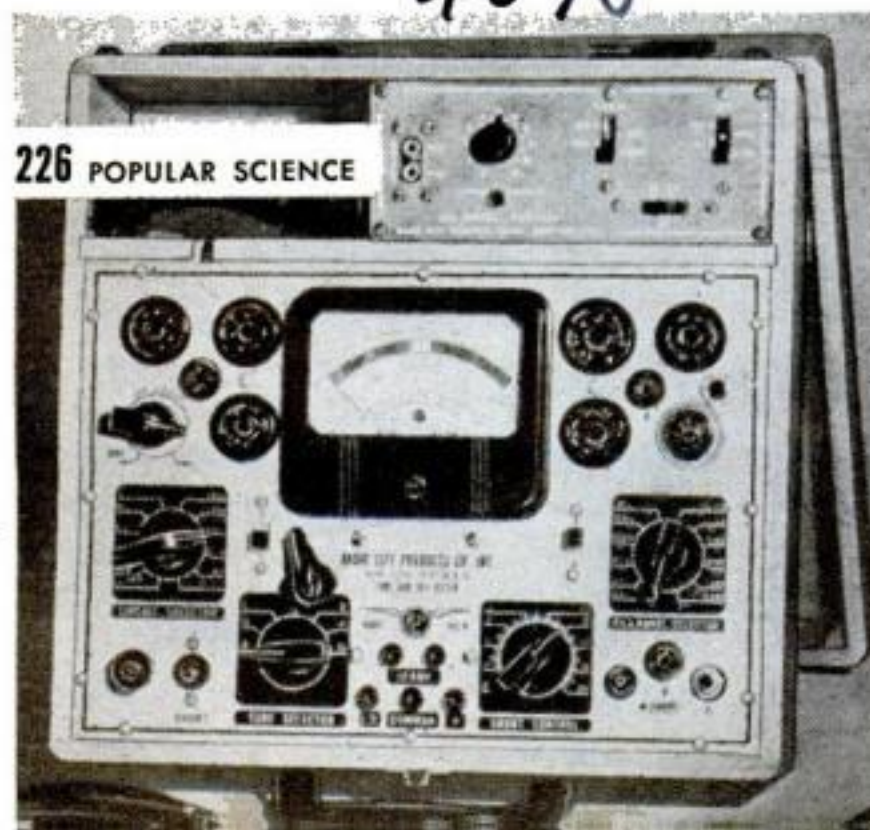
END



Three-in-One Book. Servicemen and experimenters can now study three tube-base diagrams simultaneously. A new booklet issued by RCA contains three complete sets of basing diagrams bound one above the other. The user can turn to a different page in each of the books, thus bringing together related information on over 475 tube types. It's called Triple Pindex® and sells for 75 cents.

Case Carries Complete Shop.

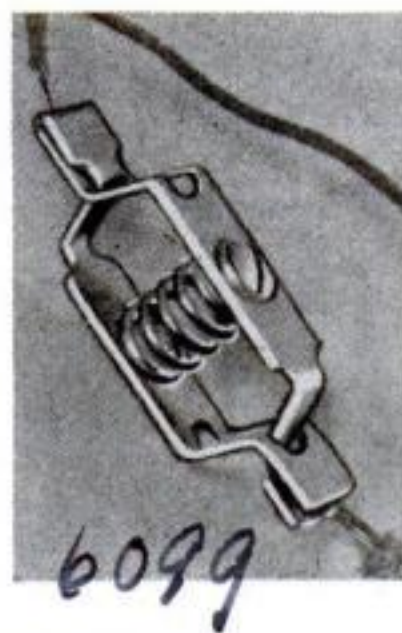
One convenient carrying case holds all the major test equipment usually required by a radio serviceman. The instrument, made by Radio City Products Company, Inc., New York, contains a tube tester, FM and AM signal generator, audio oscillator, condenser tester, and a volt-ohm-milliammeter that also can check decibels and output volts. Retail price is about \$85.



Needle Point Retracts. The sapphire tip of this phono stylus is entirely separate from the needle shaft, being held in place by a steel ball and copper spring. Since the spring exerts 1 lb. of pressure, any pressure above that—such as might be caused by dropping the pickup—causes the jewel tip to retract, thus protecting it from damage. The Weltone Company, Summit, N.J., makes the needle to retail at \$3. It is said to be good for 10,000 plays.

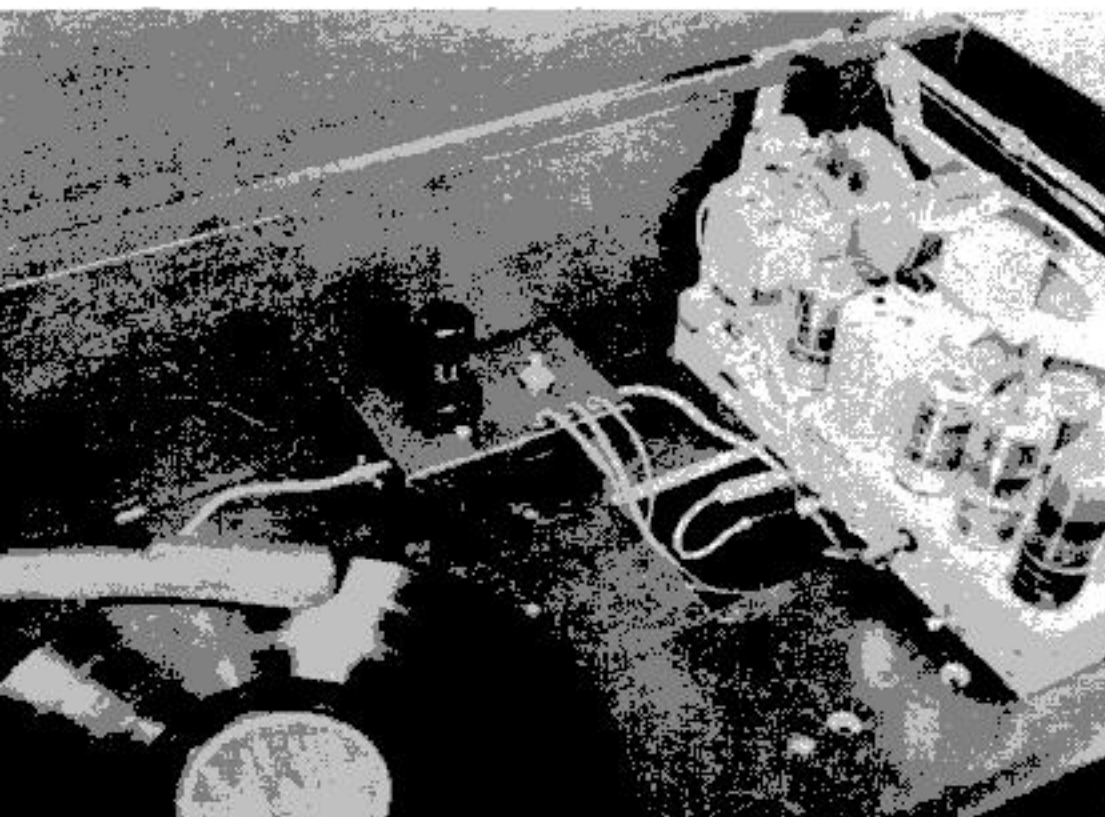
Two-Jaw Clips.

Gripping jaws at both ends of this clip enable it to perform many jobs that ordinary single-ended clips can't handle. Mueller Electric Co., Cleveland, has added it to its line of clips and related products. The clip is 2" long.

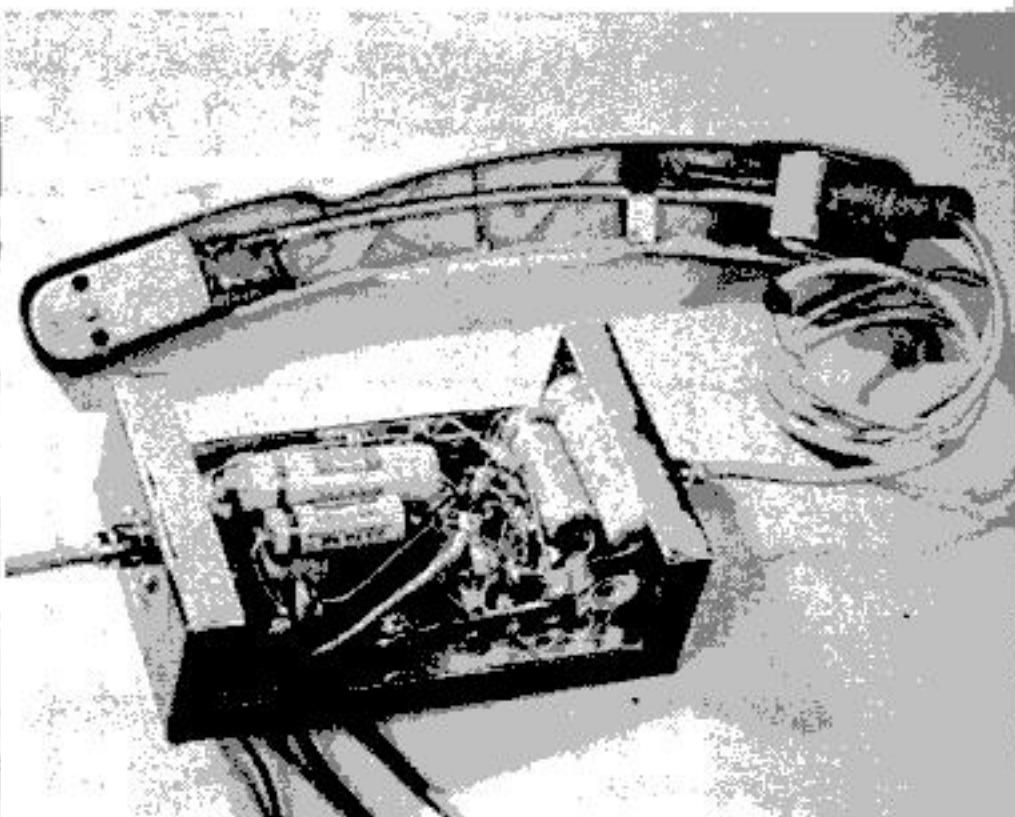


Selector Picks Sidebands. Reception in crowded amateur and communication bands is improved through the selection of a single sideband. Radio hams can enjoy some of these benefits by adding this single-sideband selector to their regular equipment. It is made by GE and is said to reinforce the strength of the carrier signal and allow selection of either sideband or normal reception.





In a test setup, the preamplifier is used with an ordinary AC-DC radio. The better the amplifier and speaker, the better the results.



The tone arm has been fitted with a GE reluctance cartridge. This pickup needs frequency equalization as well as preamplification.

Preamplifier Serves Mike or Magnetic Pickup 5352

EVEN a little radio or amplifier can do more jobs than you usually give it credit for. If its tone is good—that is, if its loudspeaker and output stages are up to snuff—it can be used as an audio amplifier for microphone or phono pickup.

The one or two audio stages in a small set, however, frequently aren't enough to get comfortable volume. They are also unsuitable for the new magnetic or reluctance pickups. Magnetic reproducers have excellent fidelity and they cut noise to the bone, but for this they sacrifice power. To use one, therefore, you have to give it a boost. Also, its frequency-response characteristics aren't suited to commercial recordings. It must be equalized as well as preamplified.

Maybe that sounds like a lot, but you can get it all with one tube and a few resistors and condensers. The little unit shown above and on the next page is truly universal in its performance. For a mike or crystal pickup, it gives all the preamplification you need; with a magnetic pickup it gives this plus proper equalization. For the latter feature alone it can be used even with a high-powered amplifier.

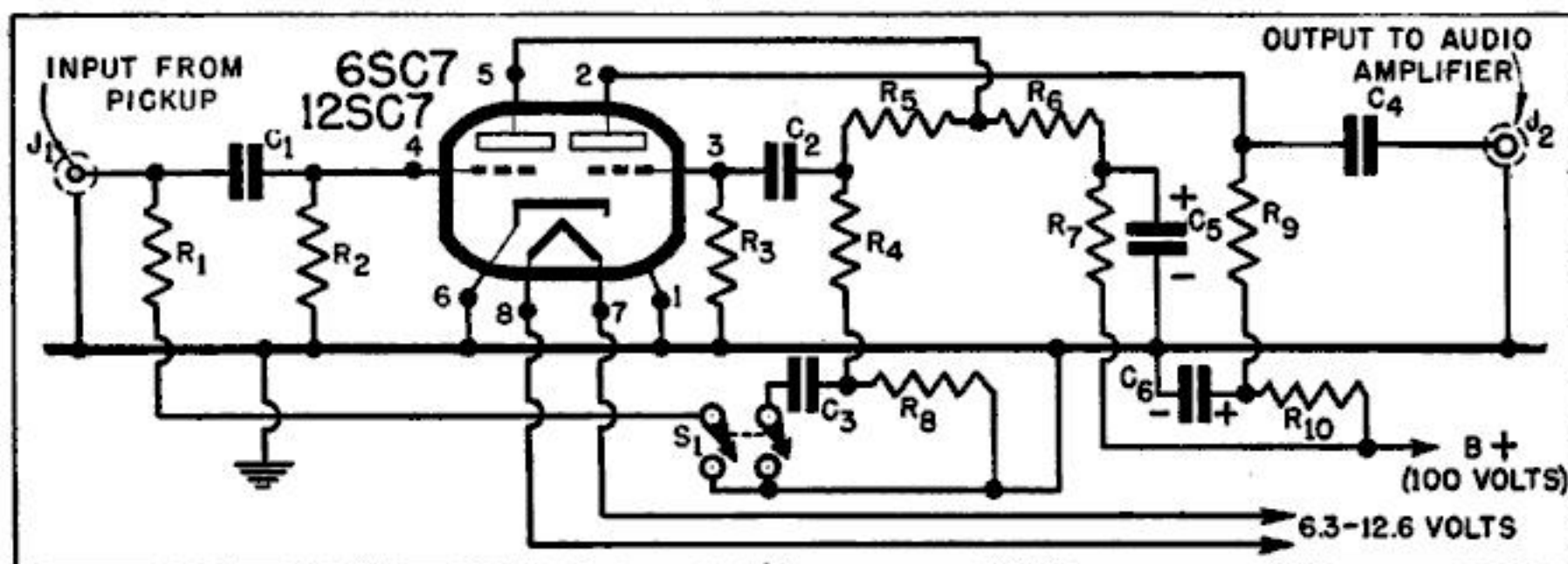
Universality is achieved in still another way, for it is designed to operate with either of two tubes, depending on the re-

quirement of the radio or amplifier with which it is to be combined. Use the 6SC7 with practically all AC radios and amplifiers. It will also suit AC-DC receivers using tubes with filament ratings of .3 amp. such as 6D6 or 6K7. Most of the newer AC-DC sets use .15-amp. heater-current tubes (e.g. 12SK7, 12K7 and 12BA6) and call for the 12SC7 in the preamp circuit. Generally the extra tube won't underpower the filaments.

If the preamplifier is coupled with an AC-DC receiver, break one of the series filament connections in the set, and insert the two heater leads so that they form part of the series circuit. With AC amplifiers or receivers, the heaters are in parallel and the appropriate leads on this unit can be connected to the heater terminals on any one of the other tube sockets. These are usually pins 2 and 7, but it is worth while to check your tubes with a manual.

The third lead from the preamplifier must be tapped into the B-plus line of the radio at some point. In small sets this is most convenient to find at the screen-grid pin of the output tube.

Many receivers and all amplifiers have jacks or terminal lugs for the phono input. Connect the two output leads to this jack,



LIST OF PARTS

All resistors $\frac{1}{2}$ -watt carbon.
 R1: 6,800 ohms.
 R2, R3: 3.3 meg.
 R4: 27,000 ohms.
 R5: 220,000 ohms.
 R6, R7: 68,000 ohms.
 R8: 180,000 ohms.

R9, R10: 33,000 ohms.
 All paper tubular condensers 400 volts.
 C1, C4: .05-mfd. paper.
 C2, C3: .01-mfd. paper.
 C5, C6: 16-mfd., 150-volt dry electrolytic.

J1, J2: phono jacks and tip plugs.
 S1: DPST toggle.
 Aluminum chassis, $1\frac{1}{2}$ " by $2\frac{3}{4}$ " by $4\frac{1}{2}$ " or equivalent; 6SC7 or 12SC7 twin triode (see text); octal socket, misc. hardware.

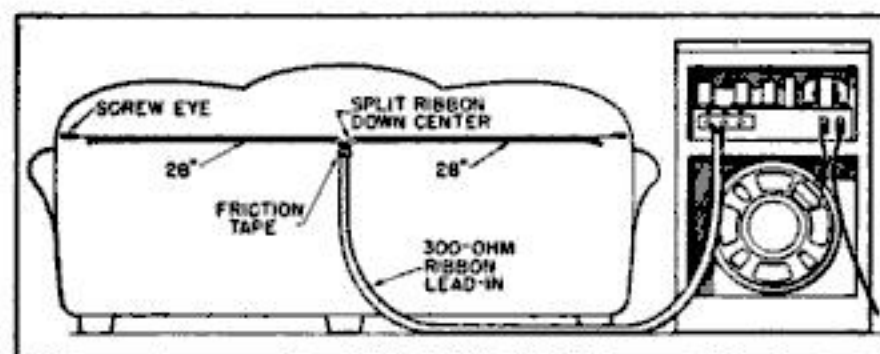
or if your set doesn't provide such a connection, bring the lead from C4 to the "hot" side of the volume control (the outside lug that is not grounded) and connect the shielded lead to the chassis of the radio. A SPST switch in series with the ungrounded lead will enable you to cut out the preamp when listening to the radio.

When using a magnetic pickup, switch S1 should be on so that the unit acts as an equalizer. For mike or crystal pickup, turn the switch off. In using a mike it is impor-

tant to maintain adequate separation between it and the amplifier and speaker. If the mike and speaker are too close together you will get a lot of feedback howl.

Inexpensive magnetic pickups are now widely distributed. The one used here is a GE cartridge. Solder a single conductor shielded wire to either one of the terminals and connect the shield to the other terminal. The shield should be grounded to the pre-amplifier chassis.—*Edward Blanton, Manhattan, N. Y.*

FM Dipole Hidden Behind Sofa

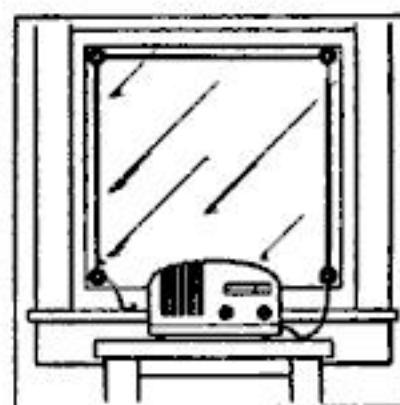


IF EITHER you or the landlord objects to your hanging an FM antenna on the roof, this indoor rig may help you get reception. Antenna and lead in are of one-piece construction, consisting of a length of 300-ohm ribbon lead-in. Wrap a few turns of tape around the wire 28" from one end and split it down the center. Drive hooks or screw eyes into the frame of a davenport and fasten the ends of the ribbon to them. The other ends go to the antenna terminals on the receiver.

Extra Loop Helps Small Radios

PORTABLES and small radios that many travelers take along often meet their match in steel-girder hotels and office buildings. Where radio reception is poor due to location, an extra length of wire may improve matters. If it is attached to a loop antenna it reduces directional sensitivity; also the extra length gives a little more pickup, which may be all the set needs to improve its reception.

Four suction cups used as pictured above offer a convenient means of spreading out the wire around a window. The cups come with molded-in bolts or clips that allow the antenna to be hooked on.—*Arthur Trauffer, Council Bluffs, Iowa.*



5371

5409

Gluing Lumber Edge to Edge



Making big ones out of little ones is standard operational procedure for furniture tops and large panels.

By Edwin M. Love

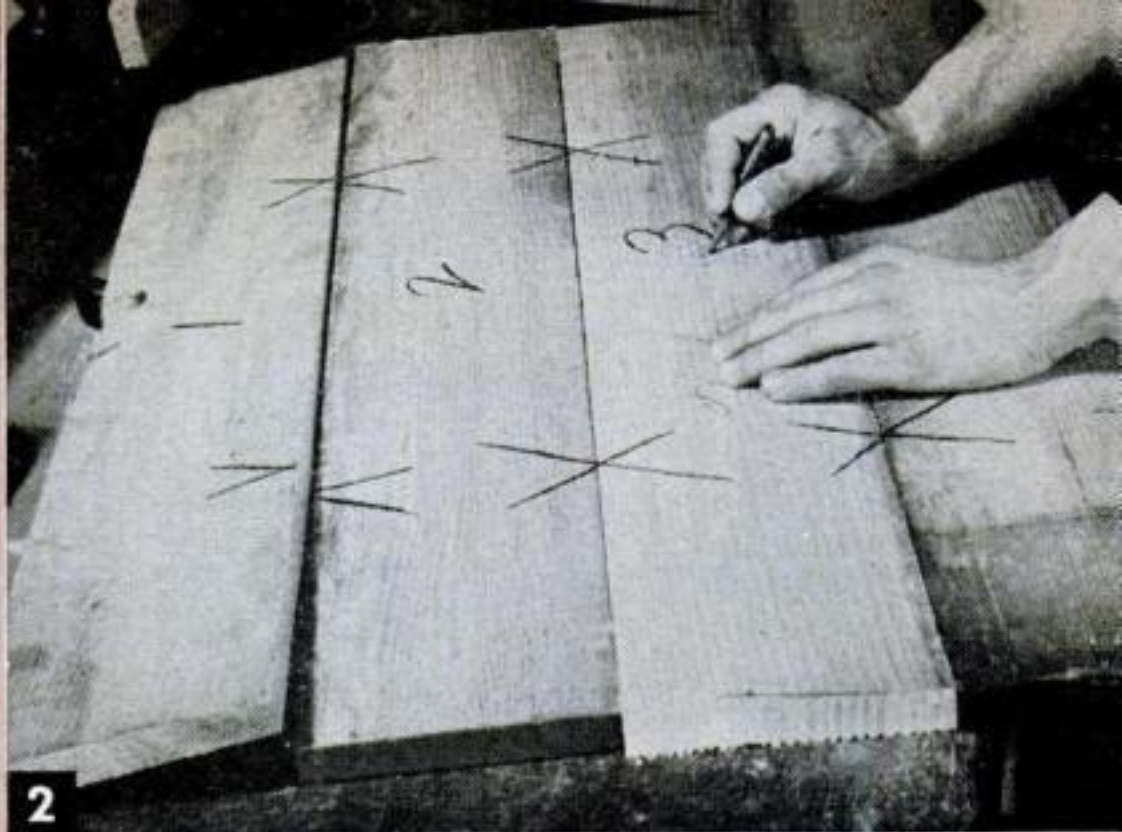
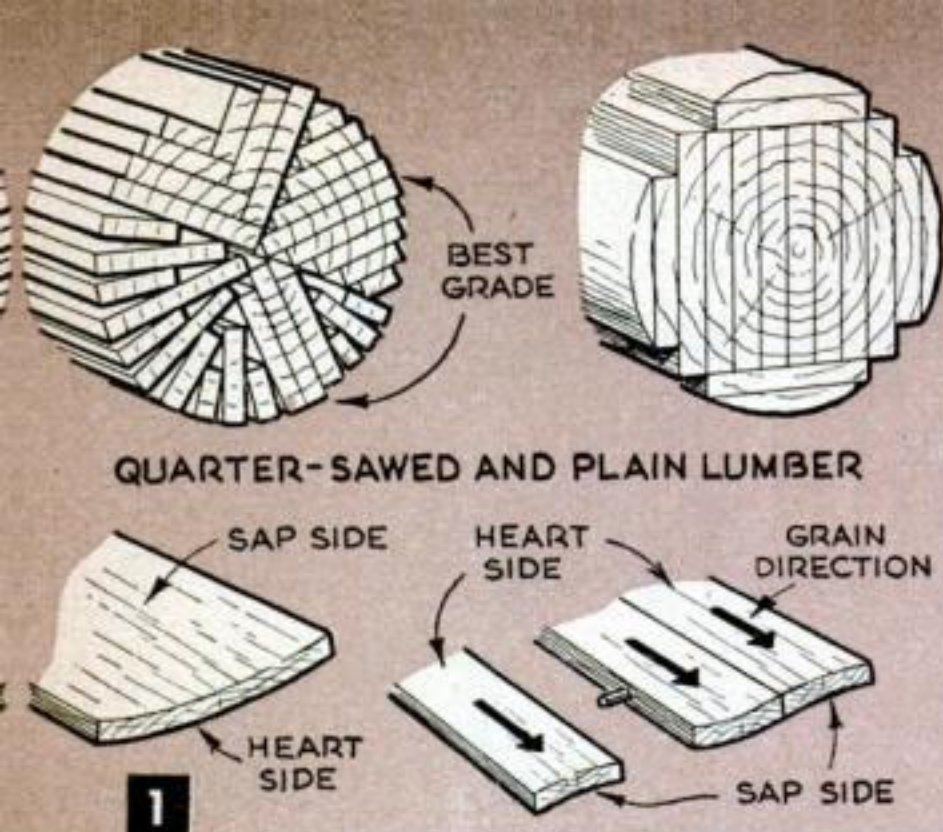
SO YOU need a wide board for that table top. It's easy enough to step around to the lumber yard and pick up a piece of plywood, but that's expensive and you can't cut a decorative molding on the edges for a varnish job. The plies would show. The answer is gluing several pieces of solid stock together.

Prepare for edge-to-edge gluing by jointing the edges of the boards until they meet in close contact. Plane the edges of the boards two at a time. Clamp two of them in a vise with their faces together and their edges at an even height. From time to time during the planing operation, test the edges for squareness. Whether or not you should surface the boards depends on circumstances. Rough down cupped or sawn lumber, but leave final smoothing to remove slight offsets in the glued joints.

Lay out the boards to be glued, alternating heart sides and sap sides as in Fig. 1.

The reason for alternating the sides is that the sap sides contain more moisture than the heart sides and therefore shrink more in drying. However, warping is slight with narrow stock and can be planed out easily. If you use kiln-dried, quarter-sawn lumber, the boards can be fairly wide. Quarter-sawn stock has a vertical grain (Fig. 1) with the exactly radial pieces being the best.

Arrange the pieces as in Fig. 2, numbering them for identification. Then test the fit by standing them on edge, two at a time, and pressing down on one end to see if the other end rocks up. If one end rises, as shown in the top drawing in Fig. 3, true the edges. Make sure the joint is tight on both sides for the full length of the boards. Next take out a shrinkage shaving (Fig. 3) from each board. Plane off just enough so you can see a fine crack of light between the boards. This puts extra compression on the ends where the wood shrinks faster because



the end grain of the wood is exposed to air.

Plain butt gluing is entirely satisfactory if you dress the boards to fit tightly and if you have plenty of clamps. Otherwise, reinforce the work with dowels or splines. In a pinch you can build your own clamps (Fig. 11) by nailing cross pieces to two-by-fours and applying pressure with wedges.

The first step in drilling dowel holes is to clamp two boards back to back. Square fine pencil lines across the edges, as in Fig. 4, starting about 3" from an end and spacing the lines 8" to 10" apart. Then gauge lines to center the holes from the edges.

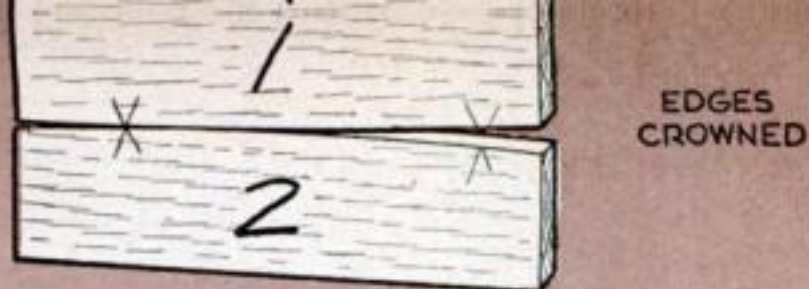
For $\frac{3}{4}$ " stock, $\frac{3}{8}$ " dowels are about right. For 2" stock, use $\frac{1}{2}$ " or $\frac{3}{8}$ " dowels. Cut them a little shorter than the combined depths of the holes to avoid striking bottom (Fig. 8). Bore the holes about $1\frac{1}{4}$ " deep (Fig. 5). Sight along the bit and the board to parallel the sides. Take an occasional look from the side, or use a try square, to check the

vertical position of the bit. If you use a bit gauge, avoid scarring the work.

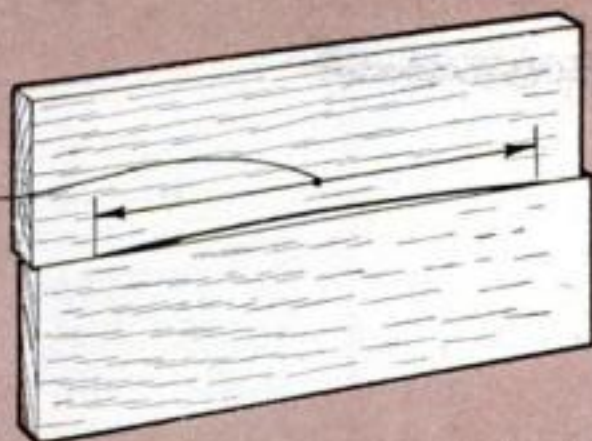
Don't bother to cut spiral grooves in the dowels. A V-groove is easy to cut and it allows glue to escape almost as well as the spiral. Chamfer the dowel ends to ease assembly. Ready-cut dowels can be bought, but it is more economical to buy them in 3' lengths and cut your own. Dowel pointers also can be bought, but a file or a sanding disk does the work in short order.

Perfect dowel holes are assured by use of a dowel jig, such as the one shown in Fig. 6. It has various sized bushings that can be clamped in place to guide the auger bit. A drill press set up for boring dowel holes is shown in Fig. 7. The work is supported by a fence, while a depth gauge regulates the depth of the holes. In using a drill press, be sure to place the face side of each board against the fence. This assures matching joints even if the holes

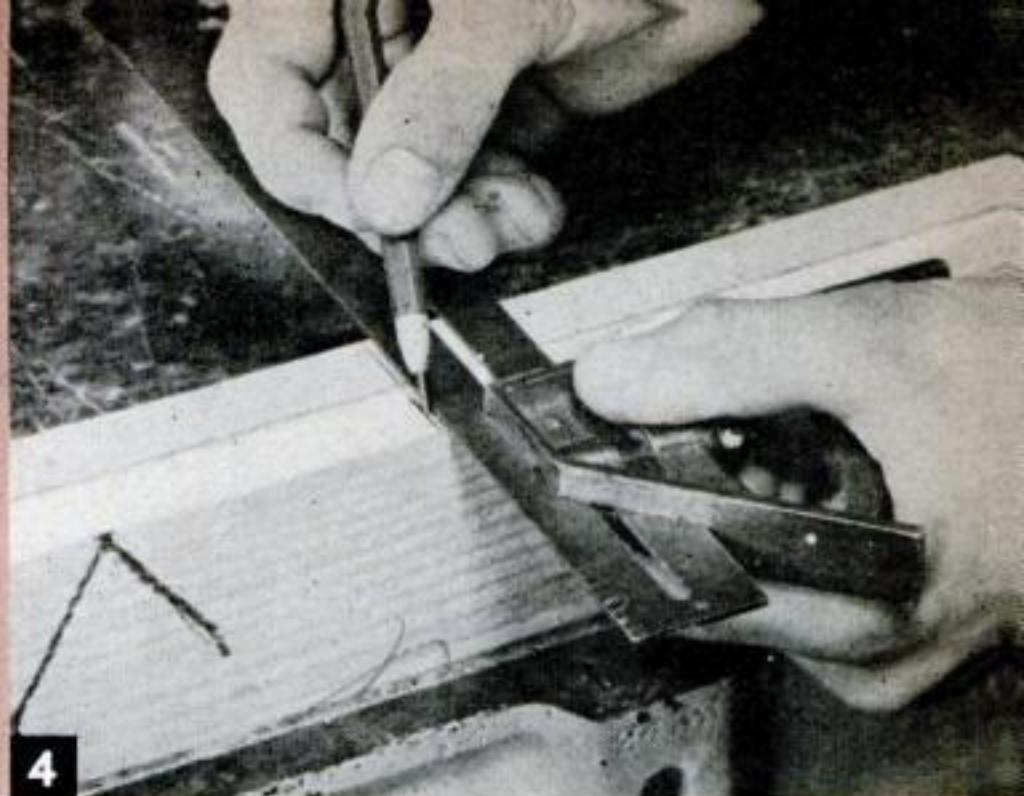




SHRINKAGE
SHAVING
STREAK OF
LIGHT



3



4

happen to be located a trifle off the center.

A spline or slip-tongue joint is pictured in Fig. 9. Plow grooves in the edges to fit a strip of wood that has been cut with the grain running crosswise. A spline cut from plywood will do. If the boards are straight, the spline will align them smoothly. To hide the spline, cut stop-grooves. That is, don't cut the grooves all the way to each end of the boards.

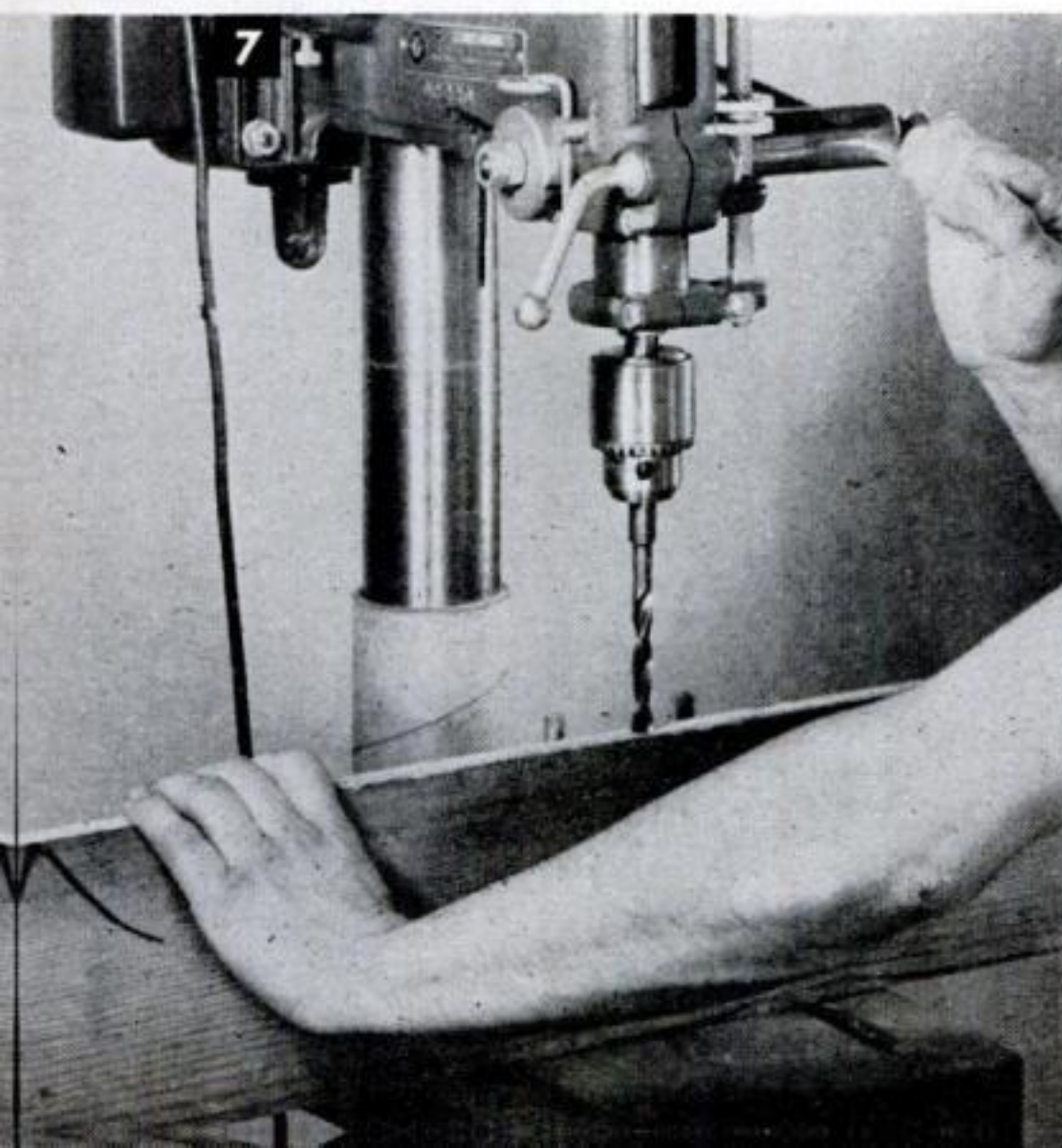
Plenty of gluing surface and precise alignment are obtained with the matched joints shown in Fig. 10. A combination plane will cut the tongue and groove joint, but a shaper or a molding head on a circular saw is necessary to make the other. Matching joints are better adapted to production methods in mills than in the home shop.

In Fig. 12 two types of bar clamps that are well adapted to home workshop use are shown. The one at right uses a screw head and a stop mounted on a length of

stout wood. It may be extended as long as needed. The other is designed to use a pipe as a bar and is a little more expensive.

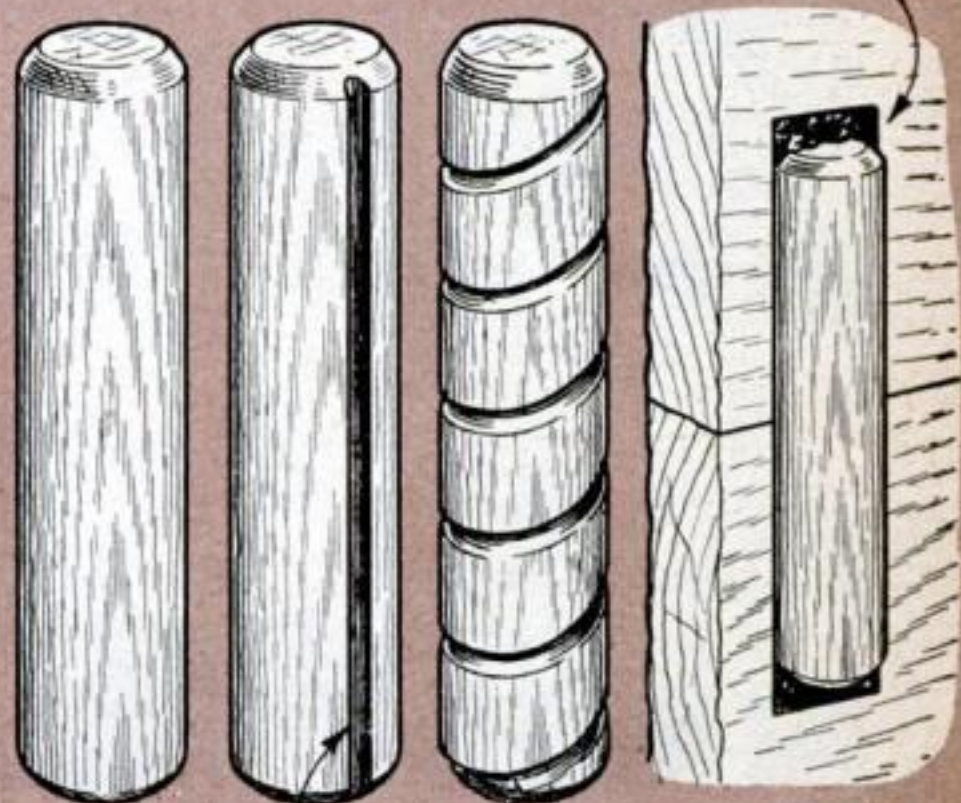
If you use commercial clamps, you'll need three of them to glue up a table top. Place a clamp at each end, spread the glue on the edges, and lay the boards in the two clamps. Then put the third clamp across the center of the boards. Tighten it first, and then the others. Use a mallet to line up the ends of the boards and test the top for flatness with a square. If the boards tend to buckle up, clamp one or two heavy boards across the top. Hold these with C-clamps.

You have a choice of several glues. Hot animal glue, a gelatine product cooked in water and brushed hot on warmed wood, is an old stand-by. The best grade comes in light-colored, translucent chips. These are soaked overnight in a little water and heated in a double boiler to produce a



7

8



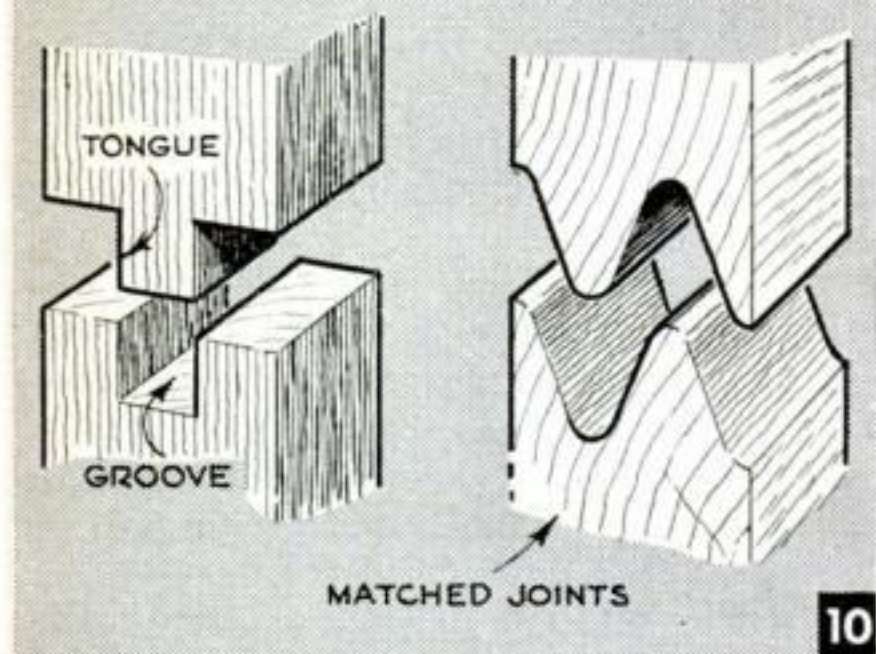
GLUE-ESCAPE GROOVE

DOWEL TYPES

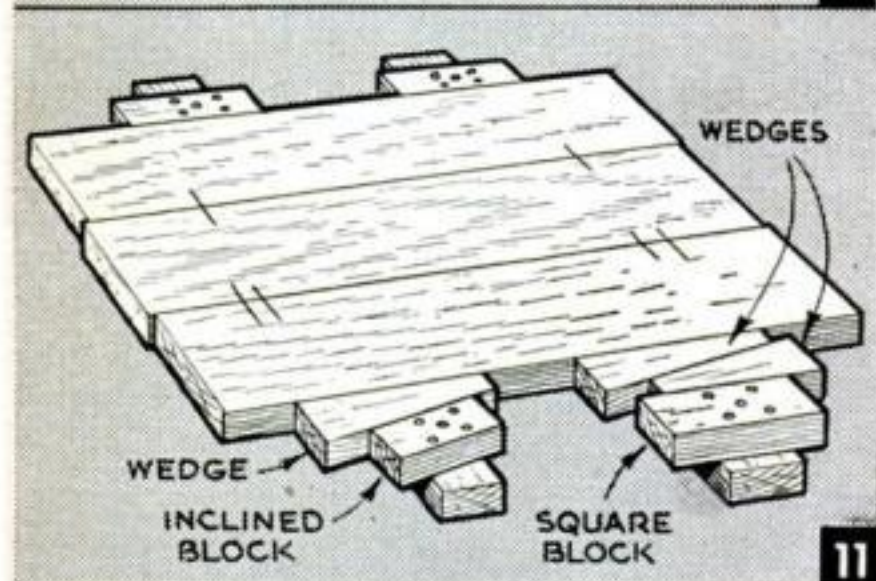
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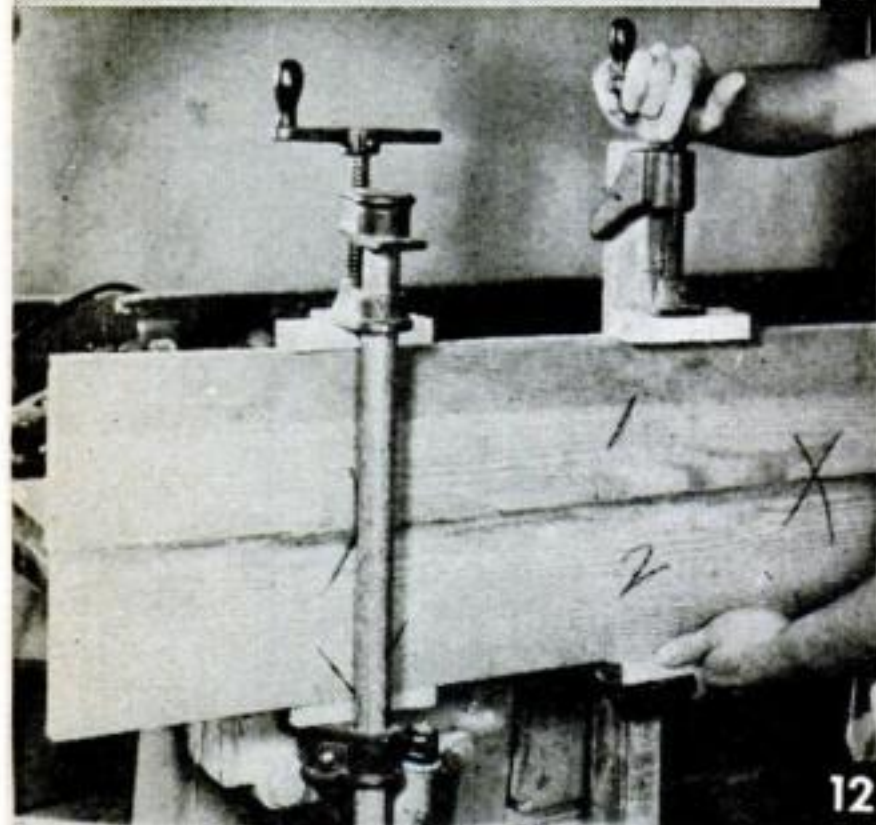
9



10



11



12

creamy liquid that strings from the brush. For maximum strength, heat a fresh batch each time, keeping the temperature at about 140 deg. F.

The matter of heat is very important. Tests have proven that the strength of animal glue will decrease if it is heated above 150 deg. F. An electric glue pot, of course, is much better in every way than the double boiler, and is usually wired so it will not heat the glue over 150 deg. F. Since animal glue chills and thickens rapidly, have everything in readiness for a speedy job. In using this glue it is best to heat the wood to room temperature. Scrape off squeezed-out glue or remove it with a damp cloth.

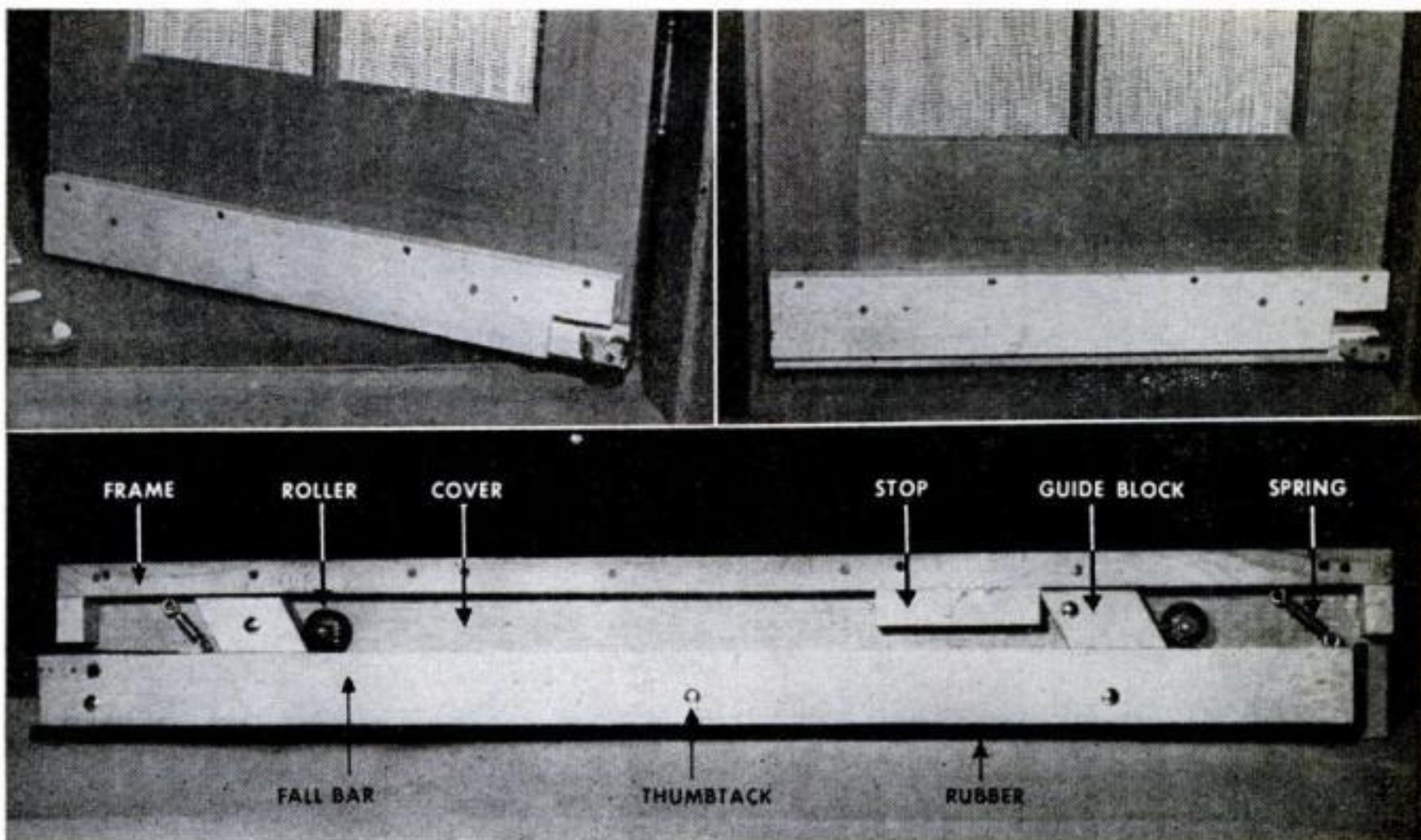
Liquid glue is suitable for involved assemblies that require a lot of time to put together. Apply it with brush or paddle, wait until it becomes tacky, then recoat places where the glue has soaked in below the surface. Leave the work in the clamps for four to eight hours. If maximum strength is wanted, do not apply strain for 48 hours. During cold weather, when liquid glue becomes thick, warm the can in a pan of hot water. As with hot glue, prolonged exposure to dampness may open up the joint.

In recent years, glues in powder form have come into wide use. The least expensive is casein glue, a light brown powder made from milk curd and an alkali. Mix it according to the directions on the package, allowing it to stand for five to 15 minutes to thin to a working consistency by chemical action. This mixture makes a water-resistant joint, but it will not stand soaking. It holds imperfect joints and great pressure is not absolutely necessary. The glue sets in about four hours. Heat speeds up the setting process. Mix only enough for the job at hand. Water-resistant varieties stain wood, a disadvantage in transparent finishes.

Very popular is plastic glue of the urea type. It is water mixed, ready for use without standing, nonstaining, and proof against water that is not hotter than 140 deg. F. For this glue, joints must be tight and held with heavy pressure. Setting chemically, the mixed glue has a life of two or three hours in hot water. Hardening of the joint is hastened by heating the work.

For waterproof outside work, a phenol-base glue is available in a wine-colored liquid that is mixed with a setting catalyst when ready to use. This glue will hold on imperfect joints. It stains the wood and is fairly expensive.

END



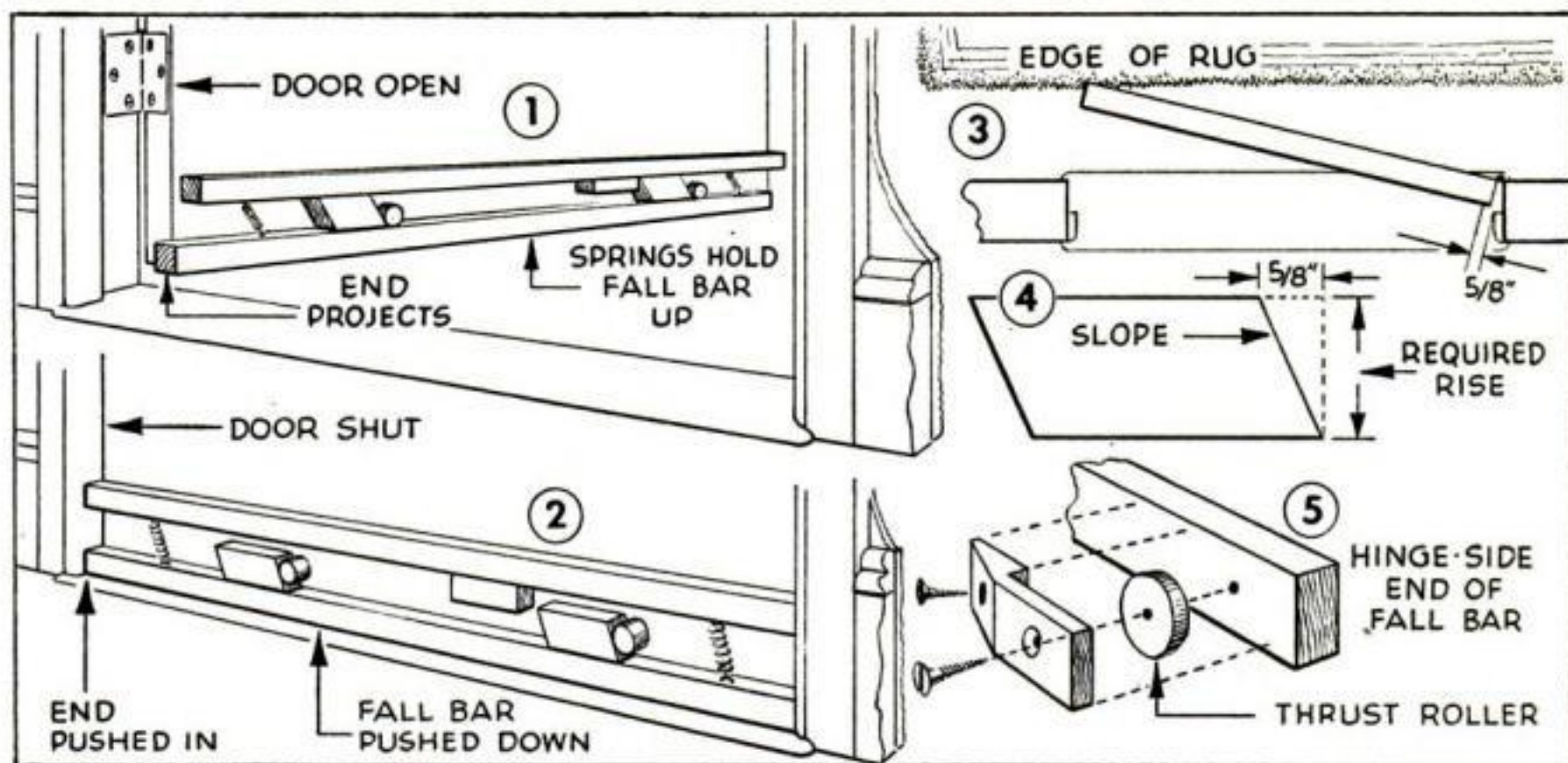
Top photos show bar with door opened and closed. Closeup shows side of bar facing the door.

Sliding Bar Stops Under-Door Draft

IF YOU have to trim the bottom of a door to clear a rug, this gadget will automatically stop the under-door draft. In building it, the trick is to determine the angle of the wedge blocks. This angle governs the point at which the bar will rise. If the edge of the rug is very close to the door, the angle will have to be small. The width of the blocks controls the height of the rise.

As the door is closed, the projecting end of the movable bar shoves against the jamb.

This forces the bar down almost to the sill. A strip of sponge rubber along the bottom and end of the bar completely seals the crack. When the door is opened, springs lift the bar to clear the rug. The rollers cause the blocks to ride freely, but you can substitute slanted blocks for them if they are well lubricated with paraffin. Thumbtacks on the wedge blocks and the fall bar will also help the bar to slide freely.—Richard B. Lewis, Redwood City, Calif.



Milk is about 87 percent water, but nevertheless it contains nearly all the essential body-building substances in easily digested form. Breaking it down into these materials is a novel chemistry project.



Taking Apart a Glass of Milk

ONE thing that makes milk an ideal food is its physical structure. It's a solution, suspension, and emulsion all rolled into one. The milk sugar (lactose) and most of the mineral salts are in solution, the

proteins are dispersed as colloidal particles, and the fat particles form an emulsion.

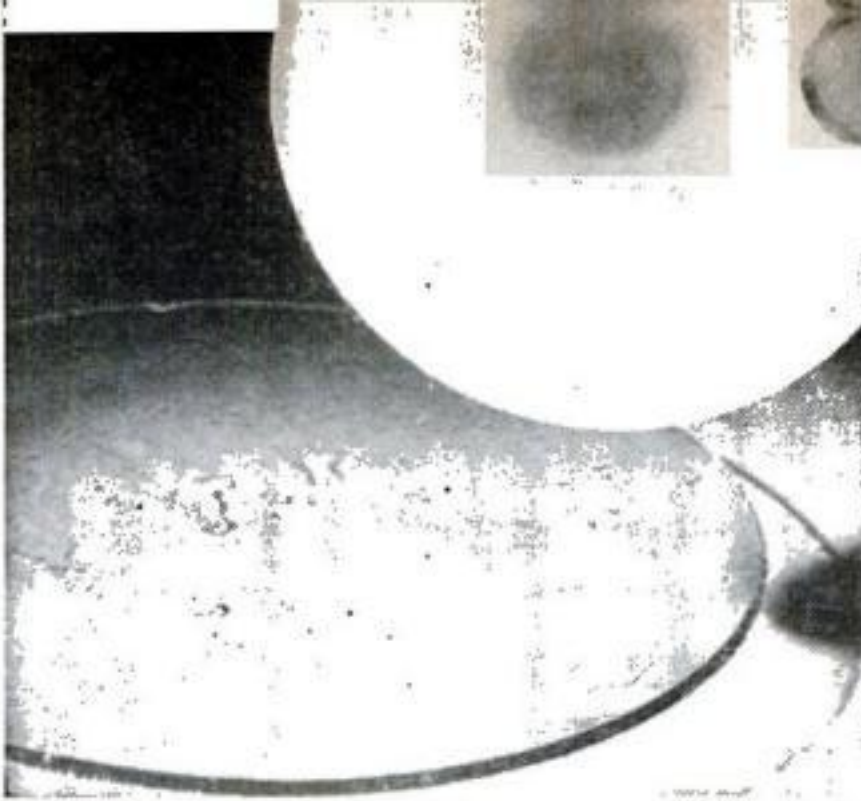
The proteins and fat are easily separated. Fat rises to the top as cream. Churning is a mechanical way of making the fat parti-

1. Begin by making some curds and whey. Use half your glass of milk and an equal amount of warm water. Mix this and stir in dilute acetic acid until precipitation stops.

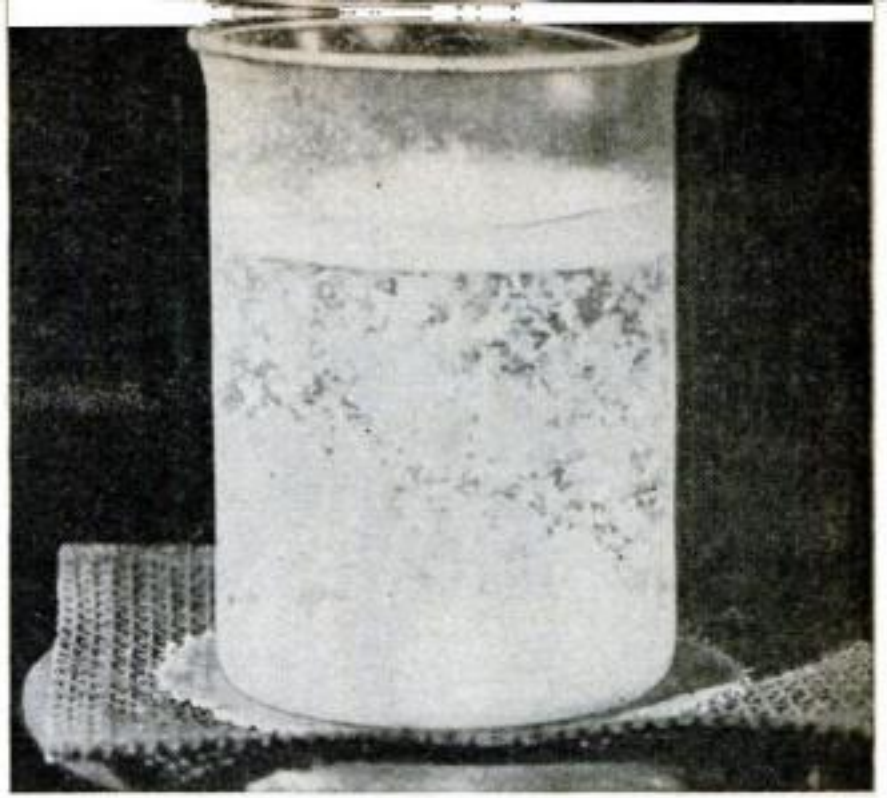
2. Filter the curds and whey with double cheesecloth. Wash the curds with water as above, put the whey receptacle aside, wash curds again with alcohol, and discard alcohol filtrate.

3. Nearly pure casein remains if you wash the fats from the curds with ether. Put only a little ether in the bottle and keep away from fire. Heat of hand drives it out nozzle.





4. Pour the ether washings into a flat dish and let evaporate in a well-ventilated room. The yellow solid that remains is fat. Smear a little on paper and it leaves a grease spot.



5. Heat the whey in a beaker. As it begins to boil, a white flaky precipitate forms. This is lactalbumin, a milk protein somewhat like egg albumin. Acid doesn't precipitate it.

cles coalesce. Casein, the chief protein, separates when the milk becomes acid, curdles, and turns into curds and whey. The curds are mostly casein.

With simple equipment and common chemicals you can separate milk into its parts. You'll produce casein, fat, lactalbumin (another protein), and sugar.

To test for two of the salts, dissolve some of the sugar in water and put 5 ml. into each of two test tubes. To one add several drops of 10 percent acetic acid and a little 5 percent ammonium oxalate solution. A white precipitate indicates calcium.

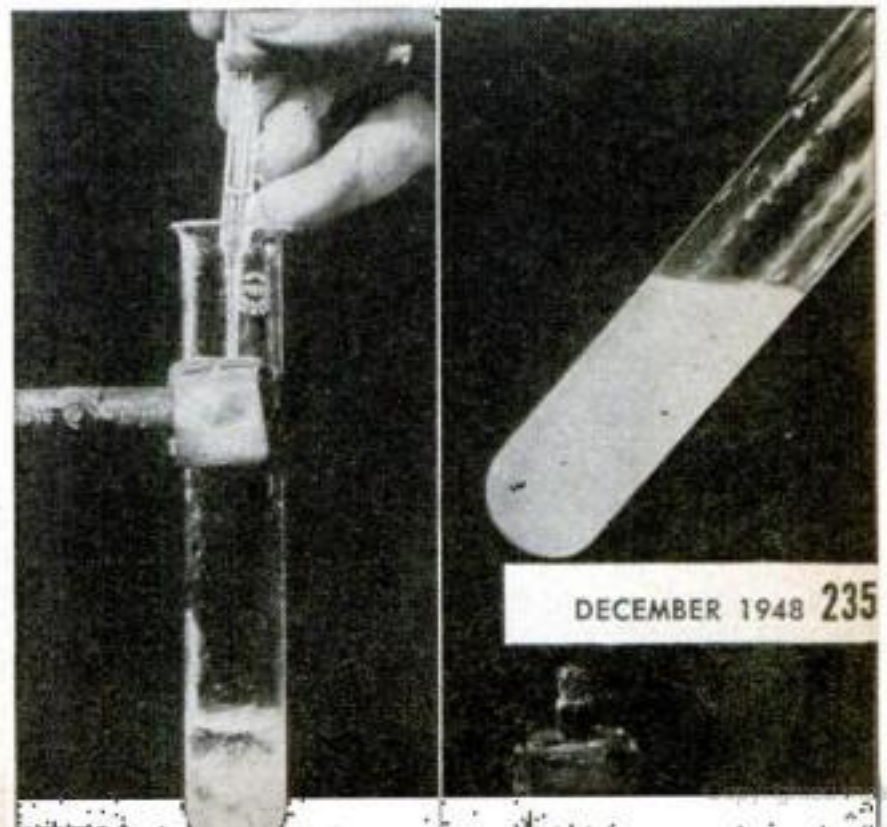
For the other test, dissolve 1 gram ammonium molybdate in 9 ml. of water and add 10 drops of concentrated nitric acid. Add 5 ml. of this solution and an equal volume of 10 percent nitric acid to the test solution. Warm gently but do not boil. A yellow precipitate indicates a phosphate.



6. The albumin can be removed by pouring the liquid through regular filter paper. When you heat milk in cooking, lactalbumin is the substance that forms on pan sides and bottom.

7. Evaporate the last filtrate over a water bath. Taste the dry substance and you'll find it sweet. This is chiefly lactose. Mixed with it are mineral salts in small amounts.

8. You can test for two salts as described in text. A fine white precipitate that forms at left indicates calcium. A fine yellow precipitate at right shows presence of a phosphate.

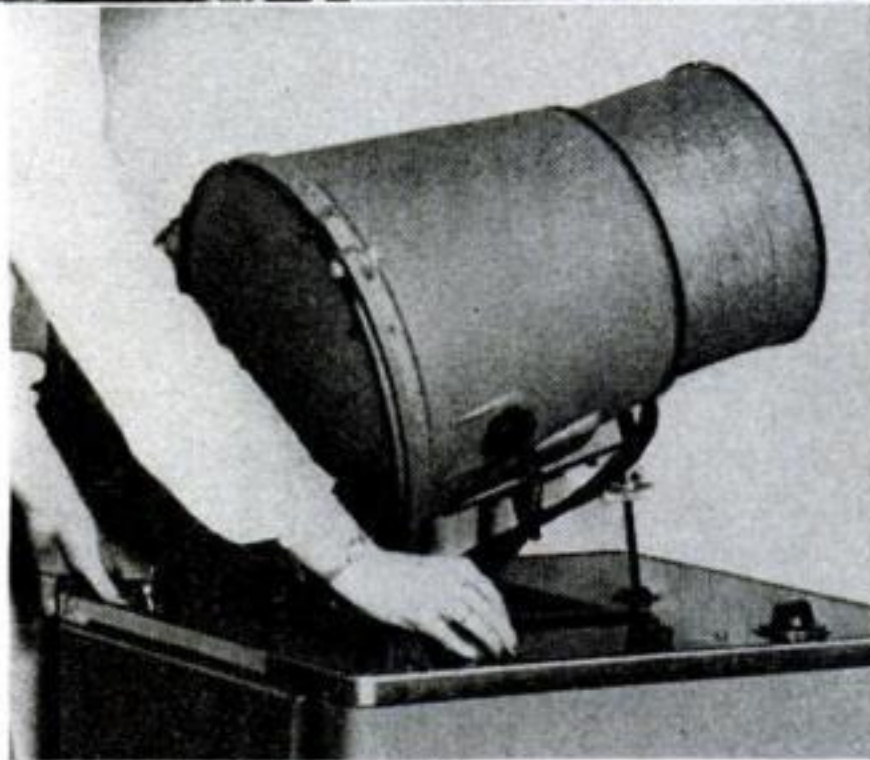


6025

6323

Seen in TV

Little Image Blows Up Big. Projected television pictures can be brought to life on a screen in sizes from a few inches up to 4' by 6' and larger depending upon audience requirements. Lens adjustments similar to those on a film projector regulate picture size. Two of the new projection sets are pictured here. RCA's set, right, employs a Schmidt-type reflective system, while the receiver made by Cortley Television Corp., New York, uses a refractive lens. The inset shows the received image covering a small portion of the Cortley's 5" tube face. Both systems are adjustable for front or rear projection.



"Flying-Spot" Saves Equipment. Beaming station-identification patterns or other fixed signals no longer requires the use of television cameras and other studio equipment. The "Flying-Spot"® cathode-ray tube, above, developed by RCA, is capable of scanning a picture slide or opaque material. It makes possible the use of a relatively inexpensive video picture generator for telecasting test patterns.

5238

Metal Tube Eases Shortage. The shortage of large-screen picture tubes that has threatened to hold up television set production may be relieved through the use of



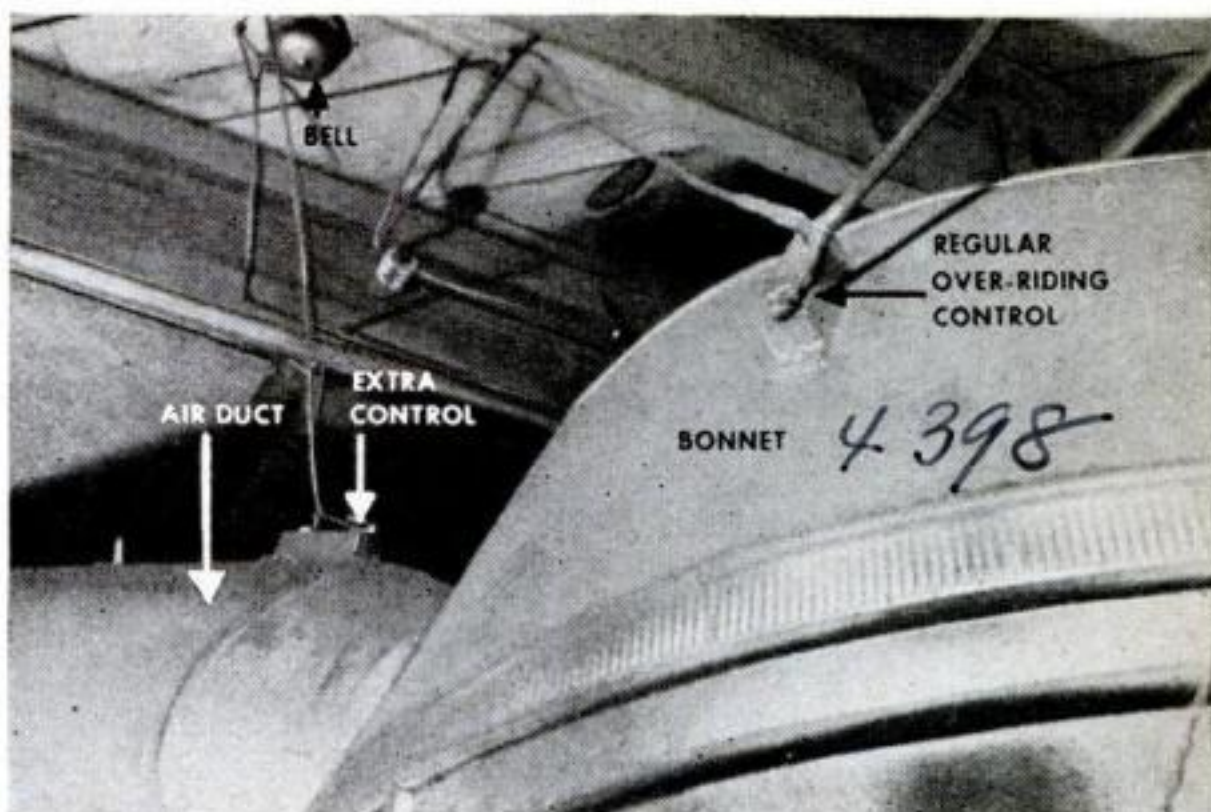
metal tubes. Announcing a solution to the problem of joining a metal shell to a glass face, Tel-O-Tube Corporation of America, Paterson, N. J., is in production with a 16" tube. The shell is spun from a chrome-steel alloy.

Antenna Questions Answered. Problems relating to television and FM installation will be answered free of charge by an antenna manufacturer. Queries may be addressed to TV-FM Antenna Installation Service, J.F.D. Manufacturing Co., 4110 Fort Hamilton Parkway, Brooklyn 19, N. Y.

6241

Overheating Rings Furnace Alarm

My HOT-AIR furnace, though fitted with an automatic damper control, has overheated dangerously when a cinder has propped open the ashpit door, or when the damper-motor chain has come off. For peace of mind, I rigged up this warning system. An extra thermostatic control, similar to the one provided with the damper motor, was taken apart, reversed to make instead of break contact with excess heat, and then wired to a bell and transformer. I mounted it on a duct normally a little cooler than the furnace bonnet, so that it doesn't ring when

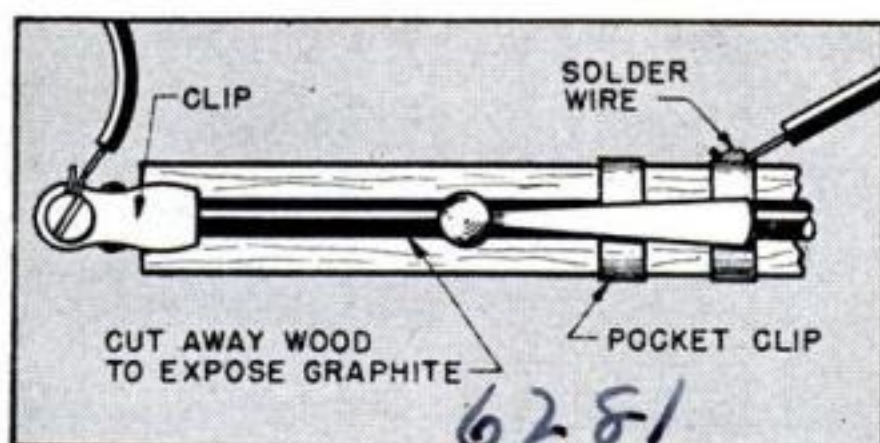


cold weather makes the furnace work hard. However, it will signal if despite the automatic control the furnace should get too hot. —W. B. Schwab, Cleveland.



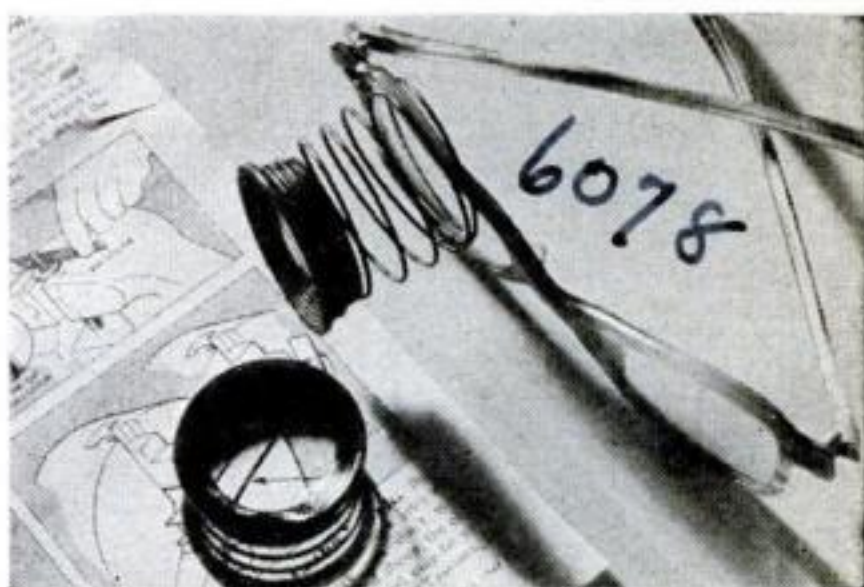
Apply Tape with One Hand

You need just one hand to apply cellulose tape with this dispenser. After a coil of tape has been threaded from the case, you press down the end, and draw the applicator along with firm pressure. When the desired amount of tape has been applied, you tilt up the device and a small knife cuts the tape. Colton Mfg. Corp., Chicago, makes the applicator for about \$1.



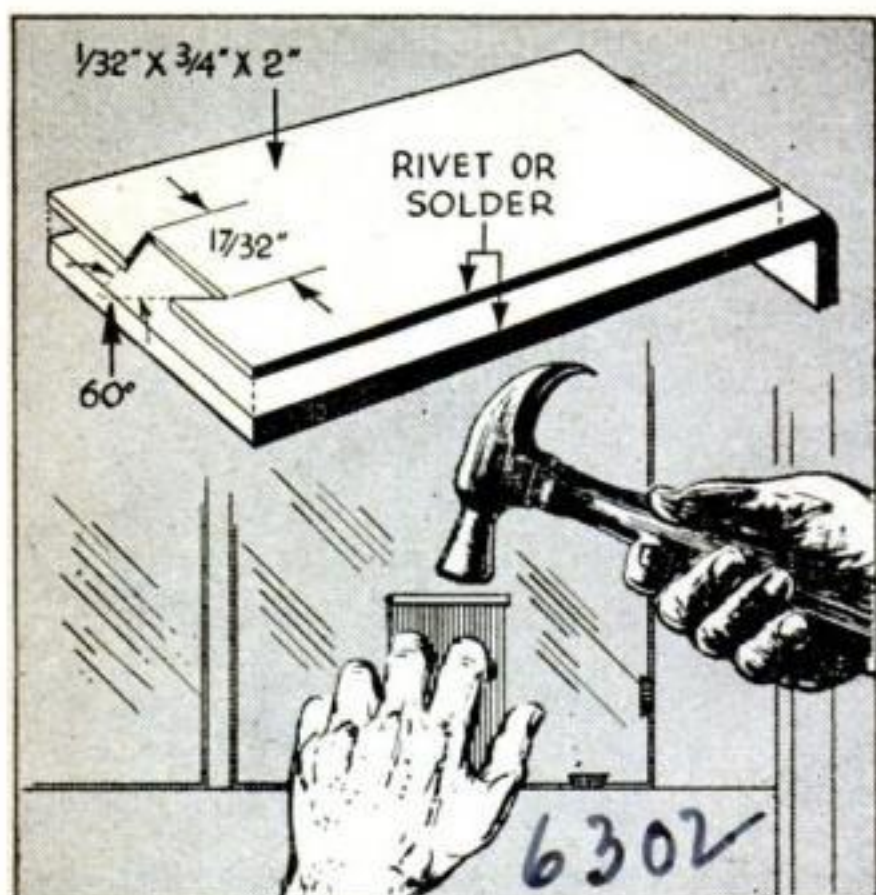
Pencil Makes Rheostat

STARTING with an ordinary pencil, you can quickly produce a low-value variable resistor for experimental work. Cut away one side of the pencil until the graphite is exposed. Then slip on a pencil clip and adjust so the ball contacts the "lead." Solder one wire to the pencil clip and the other to an electrical clip. Attach the latter to the end of the pencil. By sliding the pencil clip, you can vary the resistance with considerable accuracy.—Arthur Trauffer, Council Bluffs, Iowa.



Magnifier Worn on Specs

A COIL spring on this jeweler's-type magnifying glass serves either to hold the lens on a horizontal surface or as a means of clipping it to your glasses. You can also wear it as a jeweler does. The spring compresses so the glass can be kept in a compact leather pocket case. Called Fold-Loupe®, the \$1 lens is a product of the Birk Mfg. Co., Niantic, Conn.

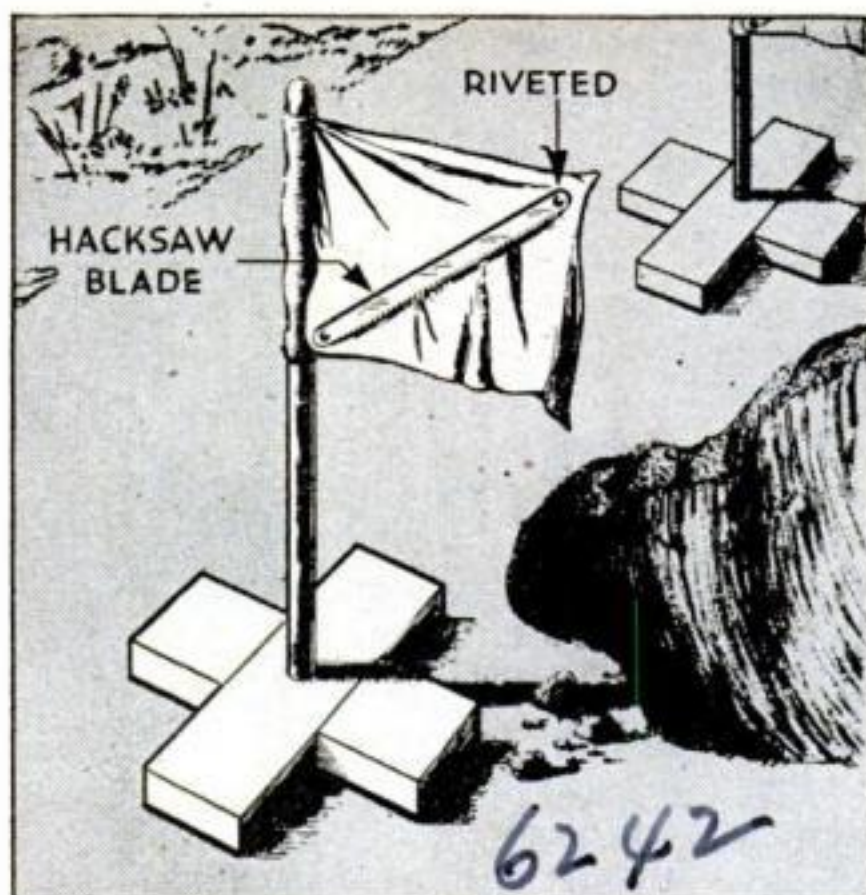
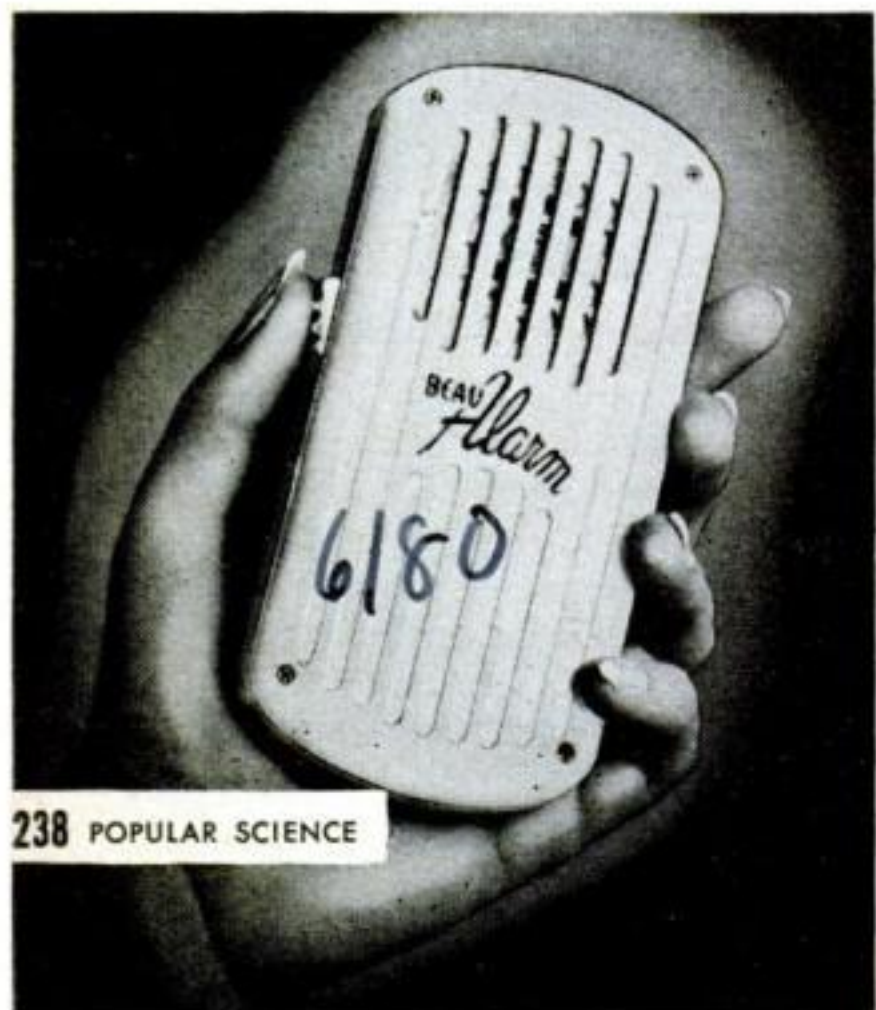


Block Holds Glazier's Points

WHEN putting in window panes or framing pictures, I find the device sketched above a great time saver. The dovetail slot holds the point firmly against the glass and frame while the other end is tapped with a hammer. Another advantage of the holder is that points may be moved to position without slipping.—*H. R. Bowman, Baltimore, Md.*

Pocket Alarm Calls for Help

OPERATED by a clock spring, the siren of this portable alarm screams for 35 seconds after the trigger is tripped. The maker, Electro-Protective Corp., Newark, N. J., suggests it might be used in the home to call for aid in an emergency, besides its obvious use by bank messengers, truck drivers, store owners, and others for protection against criminals. It can't be shut off after it is started and it may quickly be rewound.

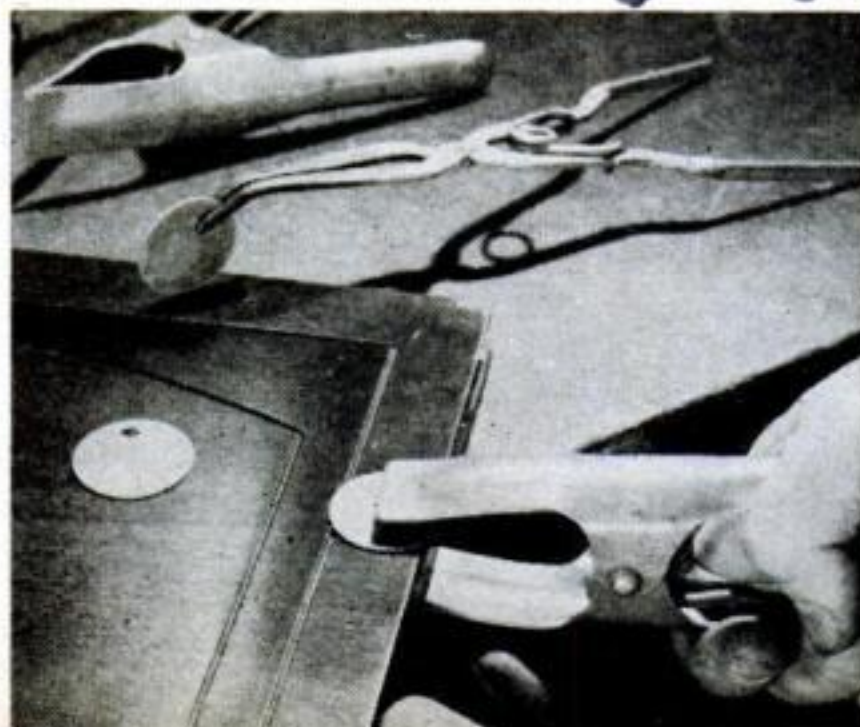


Easily Seen Danger Signals

ON A breezeless day, red danger flags at obstructions or excavations droop down around the staff and are not readily seen. Such warnings can be made more distinct if an old hacksaw blade is riveted diagonally across the flag. This stiffens the flag so it remains unfurled. Paint the blade to avoid rust.—*Richard K. Walker, Fond du Lac, Wis.*

Repairing Furniture Veneer

IF YOU have a piece of veneered furniture that needs refinishing, raised edges or blisters in the veneer should be repaired first. Heated metal disks will do this job on veneers that have been applied with water-soluble glue. Use disks of steel, brass, or aluminum about 1/16" thick. Heat them to about the temperature of a laundry iron and immediately clamp them on the blisters. The heat softens the glue by changing the moisture in the wood into steam. Pressure insures good contact between the veneer and the base until the glue hardens. Do not remove the disks until they have cooled completely. For large blisters, use an electric iron.—*Walter E. Burton, Akron, Ohio.*



6289



Early Settler's Rig Still Hauls Water Up Hill

6265

A FEW years after the waves of gold seekers had swept westward in '49, an early settler—now unknown—built this conveyor to move water 200' up a steep mountain side. Today, it serves the present owner, Al Cook, bringing water from a mountain stream to the doorstep of his cabin near Virginia City, Mont. The upper pulley is a wooden wheel turned by a crank. Nails were

driven into the rim of the wheel at an angle and the conveyer rope threaded through them. This gives enough traction to elevate a bucket of water. At the lower end, the rope travels around an ordinary pulley. As the bucket reaches the bottom of the conveyor, it comes to rest against a rock that holds it under the mouth of a pipe placed in the stream, as shown in the photo at left.

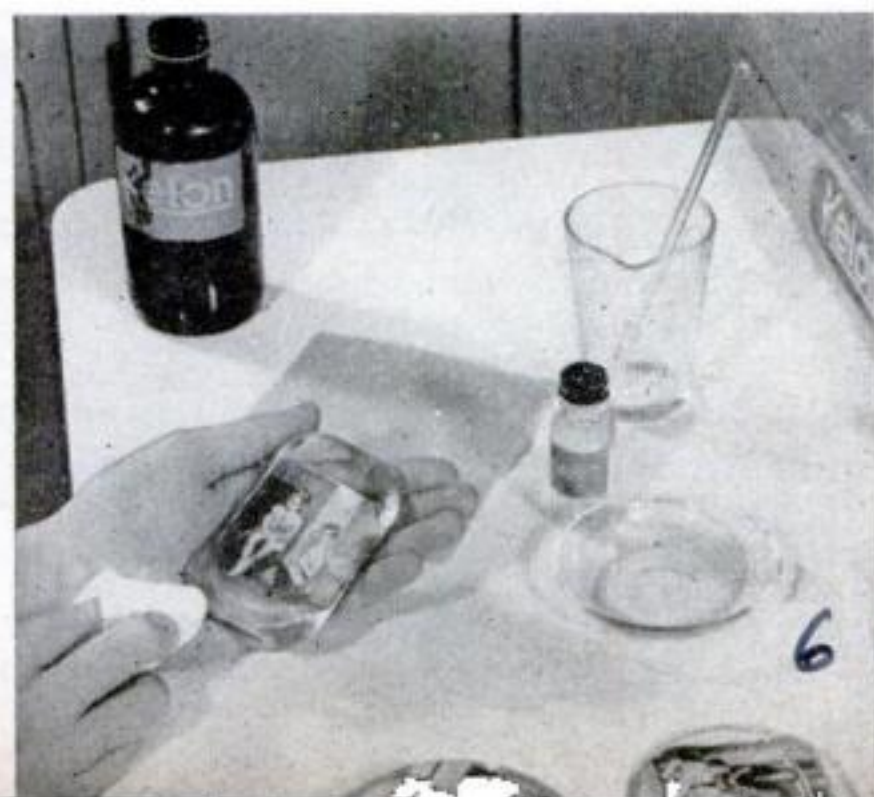
Extension Lamp Hangs by Ring

THREADED into the socket cap, a fixture ring turns an extension cord into a portable hang-up light for the home, shop, or garage. Just put screw hooks over the spots where you want to use the lamp. The ring may be taken from a discarded light fixture of the chain-supported type, or you can purchase it. It screws into the cap in place of the insulated bushing usually found there. The ring doesn't harm the cord for regular use but protects it to a certain extent.—J. M. Avery, Dexter, N. Y.



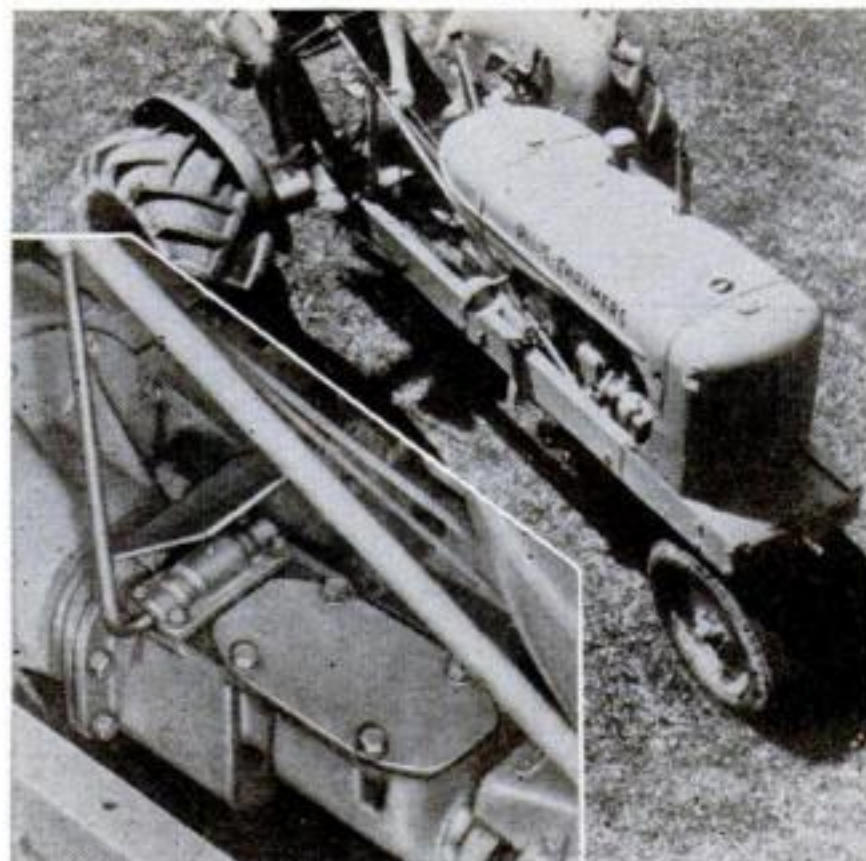
Pocket Watch Has Alarm Bell

AMONG the Swiss watches that have been reaching the market in increasing numbers since the end of the war is another one with an alarm. This one has a seven-jewel movement and is about the size of an ordinary pocket watch. The back may be opened to form an easel so it will stand like a clock. It has luminous hands and numerals with a choice of a light or a dark face. It is distributed by Harley's Clock Shops, of Kansas City, Mo. Prices range from \$16 to \$22, depending on finish.



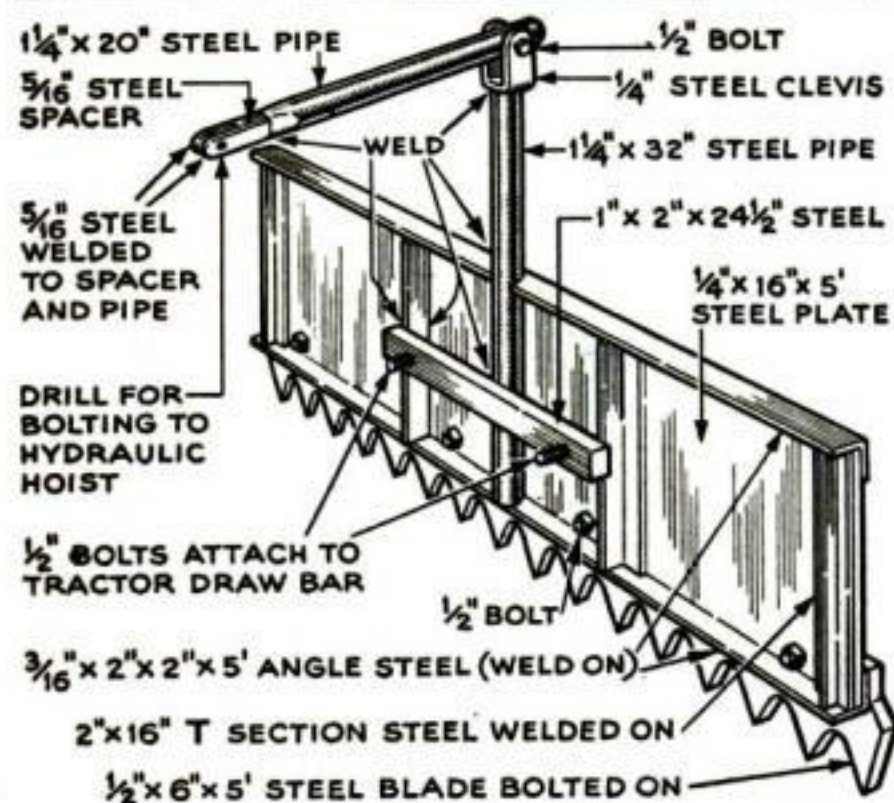
Toy Kit Molds Plastic Objects

MANY toys, gifts, and novelties of clear, thermosetting plastic may be formed with the 16-piece Kelon Liquid Plastic Kit®, according to the maker, Pittsburgh Fabric Products Co., of Pittsburgh, Pa. The plastic can be cured in a double boiler on the kitchen stove, and it may be colored, sawed, drilled, and machined with woodworking tools. The kit also can be used to embed photos, flowers, and other objects in plastic.



Extra Gears Improve Tractor

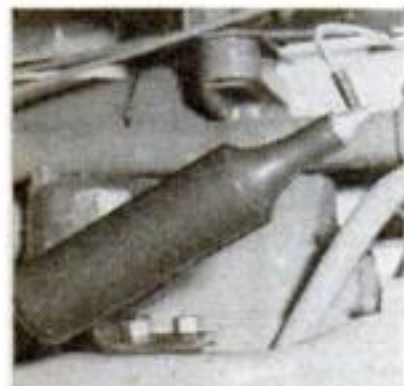
AN AUXILIARY transmission that gives a greater selection of gear speeds helps to increase the usefulness and work capacity of a tractor. The inset shows such an attachment manufactured by Sherman Products, Inc., Royal Oak, Mich., for use with the Allis-Chalmers' WC tractor. In combination with the regular transmission, it gives eight forward and two reverse speeds, with a road maximum of 14.3 m.p.h.



Rear-End Bulldozer Blade

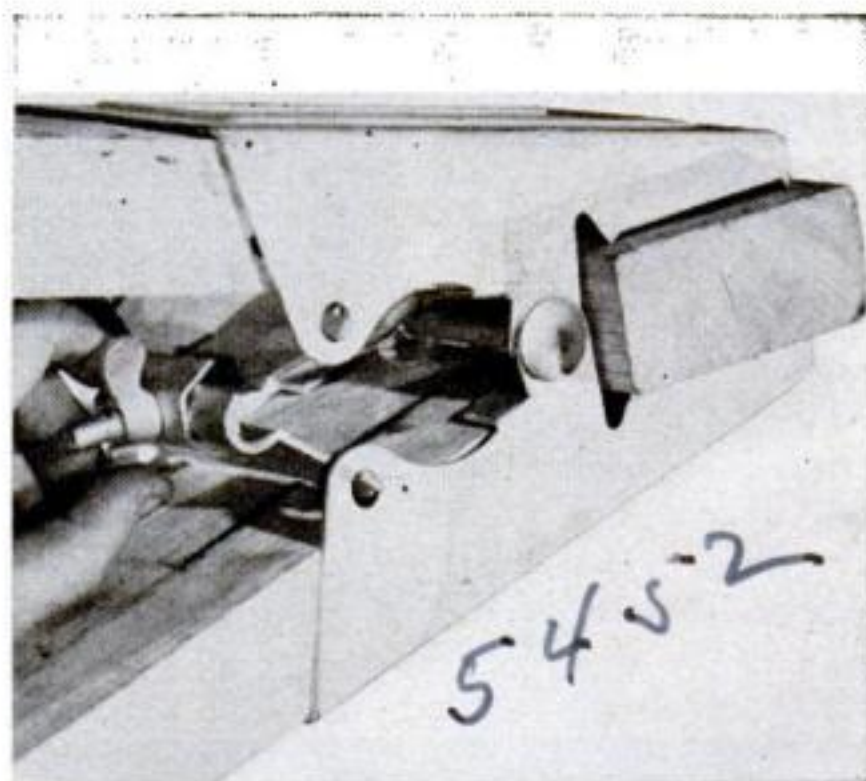
GLENN CARLSON, of Kingston, Wash., designed and built the bulldozer blade shown in the top photo and drawing, and attached it to the hydraulic hoist on his Ford-Ferguson tractor. The maneuverability achieved by this rear-end mounting enables the tractor to perform many additional farm chores.—Edward R. Lucas, Poulsbo, Wash.

Switch Stops Tractor on Tilt



6271
 TRACTORS equipped with this safety switch aren't likely to tip over on a steep incline or a heavy pull because the motor goes dead when the front wheels rise beyond a safe angle. Tilting the machine more than the predetermined limit causes a steel ball inside the cylindrical chamber to roll backward and actuate a switch that shorts the ignition. When the tractor levels, the motor can be restarted.

Warren Manufacturing Co., Inc., Clinton, N. C., produces the switch.



Brackets Hold Sawhorse Legs

FIVE pieces of lumber can be converted into a sawhorse by simple wing-nut adjustments of these sawhorse brackets. No nails or bolts are needed, so the unit can be disassembled just as readily for easy transportation and on-the-spot use. Dalton Mfg. Co., St. Louis, makes the brackets in two sizes to fit 1" by 4" and 2" by 4" stock.

**NOW PRECISION METALWORKING
AT LOW COST!**

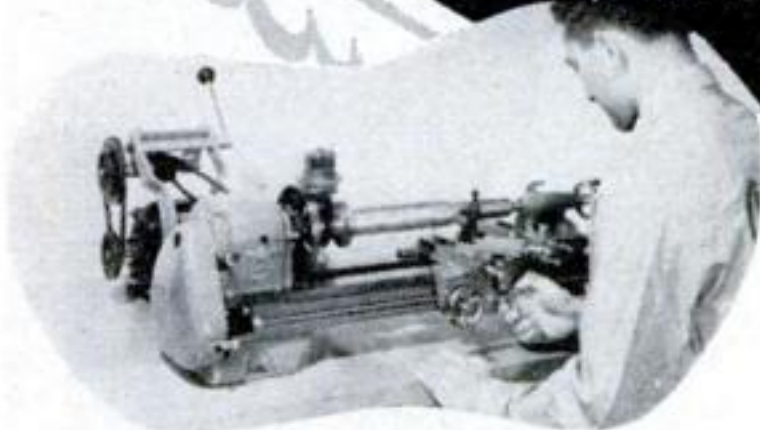
Atlas 6" LATHE

\$113⁵⁰*



- ★ Timken bearings
- ★ Precision ground bed ways
- ★ V-belt drive
- ★ 16 Speeds
- ★ Reversible automatic longitudinal power feed
- ★ Back gears
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*F. O. B. Kalamazoo
less motor



Today's Greatest Lathe Value

Precision lathe work for your home or commercial shop or garage comes at its lowest cost with an Atlas 6" lathe. You can't beat its value no matter where you look! Timken bearings... 16 speeds... 18" between centers... back gears for extra power on heavy cuts... low cost attachments for milling, boring, cutting tapers, mica undercutting, coil winding, collet work... precision capabilities to thousandths... practically all the performance features of big lathes costing several times more are yours with this Atlas 6" lathe — ready for immediate delivery. Send a postcard for new catalog — just off the press — and name of nearest dealer.



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Turns METALS, WOODS, PLASTICS

The wide speed range of the Atlas — from 54 to 3225 RPM — plus Timken bearings to assure smooth running and long wear, give you complete versatility in working all kinds of materials with this lathe.

Standard equipment includes Reversible Automatic Power Longitudinal Feed; Graduated Compound Rest; Tool Post, Ring and Rocker, 3/8" Tool Bit; Complete set of Change Gears to cut standard threads between 8 and 96 per inch; Threading Chart, Threading Dial; Rapid Lever Countershaft; Complete V-belt drive; Motor Pulley for 1/2" motor shaft (prices for other sizes on request); 60-Hole Indexing Mechanism; 5 1/4" Combination Metal and Woodworking Face Plate; Two 60° Lathe Centers — No. 2 MT for headstock, No. 1 MT for tailstock; 3 wrenches; Atlas Manual of Lathe Operation.



Set No.
9900 F

If a gift for some man has you worried remember nothing could be more appreciated than fine tools. Perfect for use on the job or at home, they will please the most particular male — whether he's 6 or 96. Singly or in sets, Proto Tools are fun to give and a joy to receive. See your dealer today. Write for catalog to Plomb Tool Company, 2257C Santa Fe Avenue, Los Angeles 54, California.

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Appreciated!**



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9900 D

4891



Table Works Two Ways

A CHILD can sit either in or *at* this new Baby-Sitter®. Using it as shown above, he can turn any direction in a swivel chair of adjustable height. With the chair removed, the center opening in the doughnut-shaped top can be covered with a matching plywood disk. This makes a larger table for one or more children—or even a coffee table for their elders. Edges of both the table and base are covered with rubber bumpers.



Scraper Built to Scale

THE road scraper at right has recently been put on the market by the Cruver Mfg. Co., of Chicago, as a companion piece to the tractor to which it is coupled. Copied after a real-life counterpart, on a scale of 1 in. to 2 ft., it is assembled from 15 plastic parts cast in only two molds—one for the larger pieces, one for the smaller fittings.

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more new cars
-sold by more
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DELCO
BATTERY

DELCO-REMY WHEREVER WHEELS TURN OR PROPELLERS SPIN

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Kitchen equipment

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Fabricating equipment of your own design

Eight famous P & H industrial electrodes now conveniently packaged for automotive, general repair, job welding, and machine shops; foundries; schools; etc.

You save welding time and do better work, when you always have the right electrode for the job.

P & H Shop Packs consist of eight different packages of electrodes. Detailed instructions are printed on each individual package so that you can use the right electrode for every job.

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And you can weld anything made of steel, alloy, or stainless steel, sheet metal, cast iron. You can also put hard, protective, long-life surfaces on new parts, or build up worn parts better than new. P & H Shop Pack electrodes let you do a wider variety of work — at lower cost.

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The cost of all 8 Shop Packs, individually packaged and labeled for your convenience, is only \$11.75.

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The use of individual packages means that you only have to reorder the types you need — at little cost. Maintaining a complete range is easy. You can always handle any job that comes up.

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It pays to use P & H packaged electrodes. No matter what make of welder you have, no matter whether you use AC or DC current, order P & H Shop Packs today from your nearby P & H distributor.

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Purchase P & H Shop Pack electrodes (\$11.75). Check their speed, quality, easy manipulation, and wide variety of uses. This small investment paves the way to lower

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As a further aid to reducing costs, we suggest that you investigate the new P & H AC Arc Welder. This is the only welder with easy-to-use Dial-lectric control. It has no moving parts and needs no maintenance.

Connectible to 220 or 440 volt current, the P & H Dial-lectric machine requires only 2 1/4 feet of floor space. Built-in remote control; easy, quick-start arc; high-low welding range; elimination of arc blow; and the simple radio-like knob that provides complete welding range from 20 to 275 amps with a 1/4 turn — all these features make for better, faster welding.

Contact your nearby P & H distributor for complete details about America's most complete welding service, or mail the coupon below, clipped to your business letterhead.



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Amazing MOTO-SANDER AND POLISHER

Saves Time—Saves Elbow Grease!

Here's an inexpensive Sander and Polisher so easy to handle that a child can use it. All you do is guide it! Moto-Sander delivers 7,200 strokes a minute... does a magically smooth job... gets into places other sanders can't reach. Has only two moving parts... never needs oiling or adjustment. Uses 110-120 volt, 60 cycle A.C. electric current. Has 8 ft. (Underwriters' Approved) rubber cord. Furnished with 6 sheets assorted grade Garnet paper for sanding, plus $\frac{1}{8}$ " thick felt pad and sheepskin pad for wax polishing.

Only
\$14.85

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FINE FINISHES—FAST!

Use Moto-Sander to get satin smooth sanded finish on woodwork, stairways, doors, furniture; ideal for finish sanding of boats, painted walls, bird houses or scale models. Use it also for speedy, effortless polishing of waxed furniture, automobiles and other surfaces, simply by removing sandpaper and clamping on polishing pad. Moto-Sander is the lightest, most practical electric sander on the market, and is patented.

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See Dremel Moto-Sander at your dealer's. If he cannot supply you, use coupon below to order on 5-day trial, money-back guarantee. Moto-Sander will be sent complete and postpaid for \$14.85 (check or money order in full). Or, send only \$2 with order and pay postman balance plus postage upon C.O.D. delivery. Remember, YOUR MONEY BACK if not delighted after 5 days' trial.

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Dept. SP128-L

Racine, Wis.

Manufacturers of the famous
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EASY FOR
AWKWARD PLACES



SANDS FLAT
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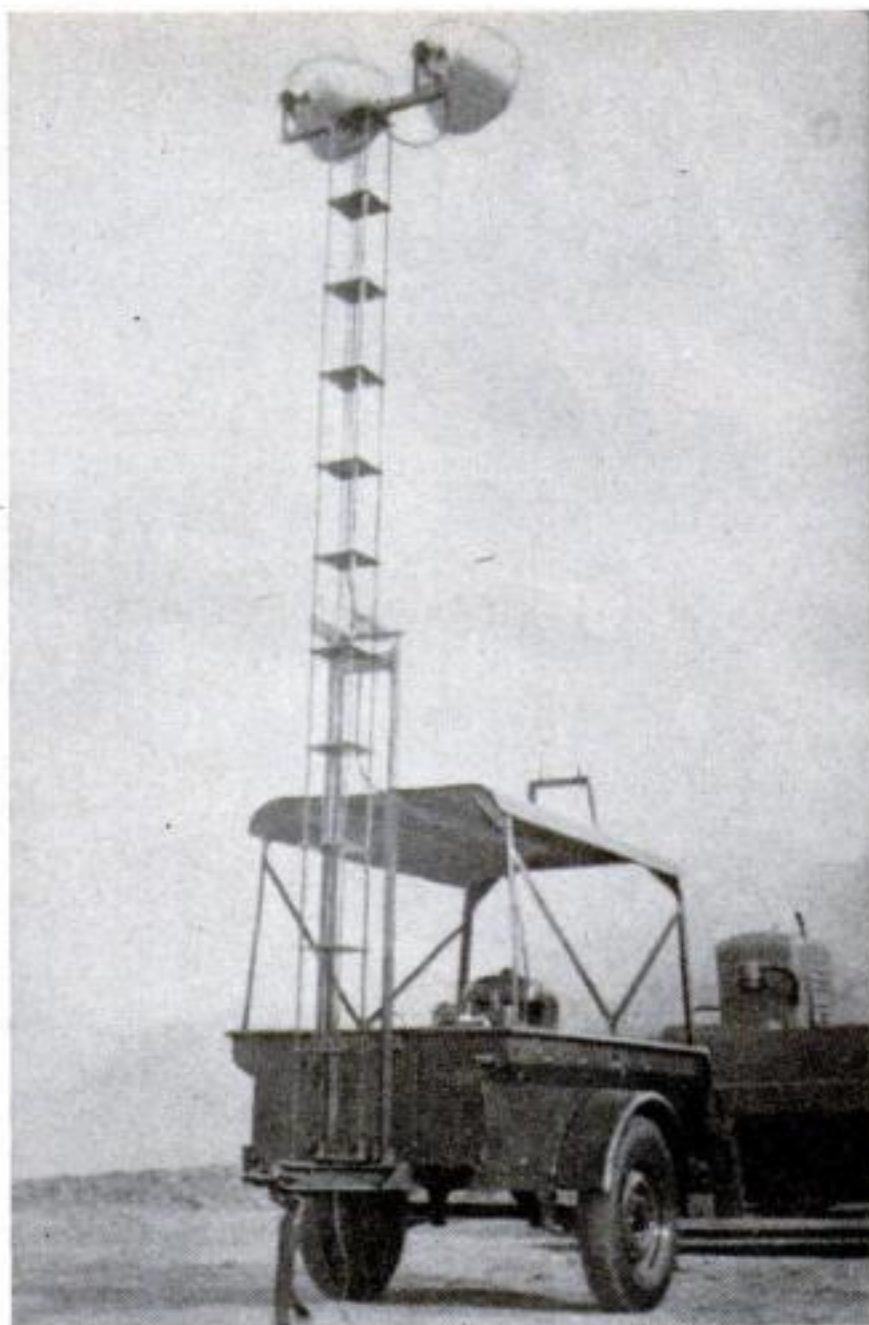
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Trailer Carries Floods

CONSTRUCTION and emergency crews working at night can hook this small Bantam trailer to a truck or car and carry their lights right up to the scene. Two 1,500-watt flood lights are mounted atop the trailer's 18-foot-high, folding tower. A gasoline-powered generator supplies the electricity.



Rifle Has Round Bolt

SMOOTHER action and a more precise fit are claimed for this round breech bolt that replaces the usual square bolt in Marlin's new line of high-power, lever-action rifles. A solid steel bridge in the receiver provides greater rigidity and a streamlined appearance. The receiver's surface is matted to reduce light glare for better sighting.

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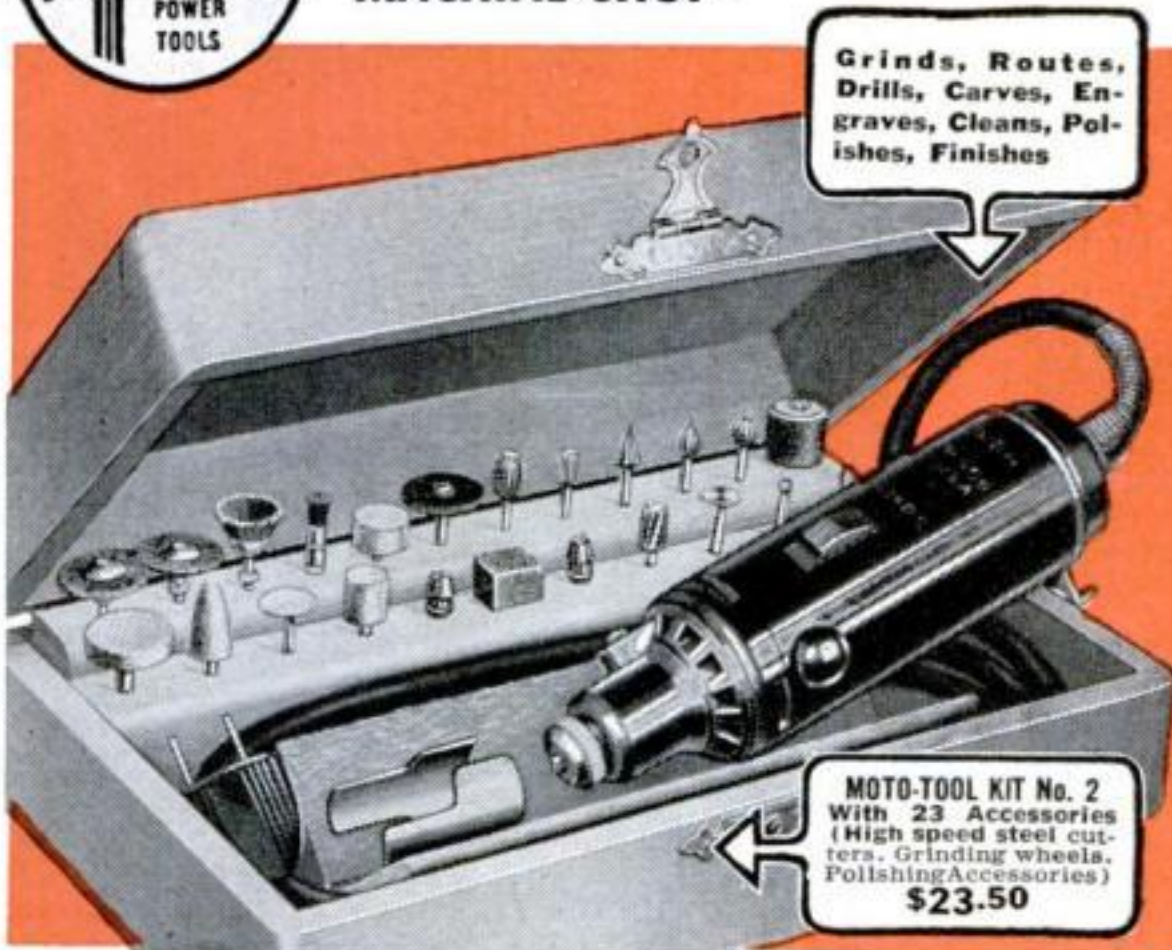
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THE "POCKET-SIZE MACHINE SHOP"

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MOTO-TOOL KIT No. 2
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(High speed steel cutters, Grinding wheels, Polishing Accessories)
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Saves Time and Labor

A SHOP TESTED TOOL

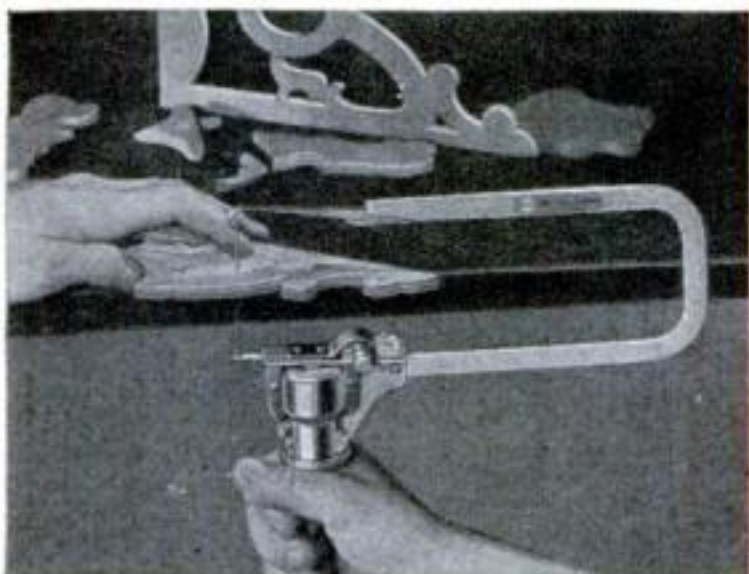
Moto-Tool is backed by over 12 years of industrial use . . . packs years of extra pleasure . . . yet, due to increased production, pre-war prices still prevail!

Look for These Moto-Tool Features

Oil-less, sealed bearings • Patented automatic chuck lock pin • Oversize armature shaft; hardened, ground, polished • Shockproof, bakelite housing • Dust filtered air cooling system • Dynamically balanced for vibrationless operation • Exclusive hanger hook • Weight only 13 ozs.

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THE AMAZING ELECTRIC SCROLL SAW



This electric coping saw works like magic! Easily cuts intricate scroll designs in medium-hard wood up to $\frac{3}{4}$ " thick. Runs 7,200 strokes a minute . . . just guide it! Has only two moving parts . . . never needs oiling. Operates on 110-120 volt, 50 or 60 cycle A.C. electric current. As safe as a handsaw . . . thousands of satisfied users. Comes complete with 3 saw blades, at only **\$5.85**

New DRILL PRESS

ONLY **\$9.95**

(Less Moto-Tool)

Only Dremel offers you a portable, precision drill press at such an amazingly low price. Just the thing for creating costume jewelry, model making, wood carving, routing, etc. Utilizes Model No. 2 Moto-Tool, which can be raised or lowered, swung in any direction, or quickly removed for off-hand use. Drill Press stands 12" high. Base is $6\frac{3}{4}$ " x 4". Weighs approximately $3\frac{1}{2}$ pounds.



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Buy Dremel Tools from your dealer. If he cannot supply you, use coupon below to order desired items on 5-day trial, money-back guarantee. Items checked will be sent complete and postpaid for check or money order in full. Or, send only \$2 with order, and pay postman balance plus postage upon C.O.D. delivery. Remember, YOUR MONEY BACK if not delighted after 5 days' trial.

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Here's BIG VALUE!



Model No. 1
MOTO-TOOL KIT
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This highly popular Kit contains lighter Model No. 1 Moto-Tool and 34 practical accessories in attractive, lacquer-finish wood box. It's the biggest bargain in the field.

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☐ Enclosed find \$2.00 as part payment on items checked. I will pay postman balance plus postage upon C.O.D. delivery.

☐ Moto-Tool Kit No. 2, \$23.50.

☐ Moto-Saw, with 3 blades, \$5.85.

☐ Moto-Tool Kit No. 1, \$17.50.

☐ dozen blades (60c per doz.)

☐ Drill Press (Less Moto-Tool), \$9.95.

☐ Free catalog of Dremel Tools & Equip.

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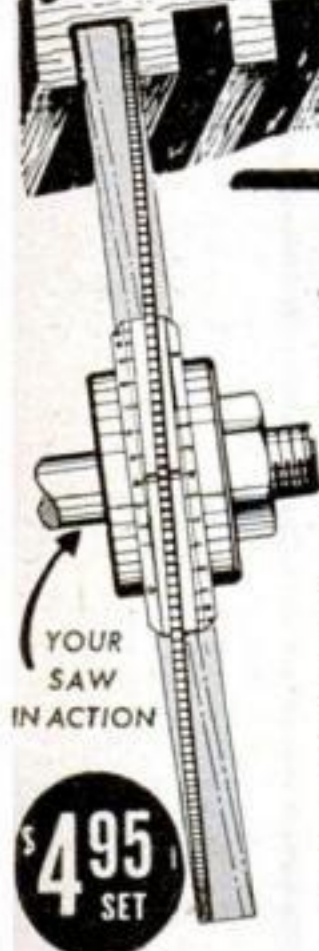


Just dial ANY WIDTH CUT
ON YOUR SAW

WITH

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Warren



Cut clean, accurate, parallel grooves—12 widths, any angle. No chatter, burning, chewing—or sanding! No more blade vibration—no screws to fuss with—just four balanced washers. Simply dial desired width with Micromatic adjustment. Can be left on blade for straight cuts. 5 sizes fit any arbor— $\frac{1}{2}$ ", $\frac{3}{4}$ ", $\frac{5}{8}$ ", 1", $1\frac{1}{8}$ ". A perfect gift for woodworkers. See your dealer or use coupon below!

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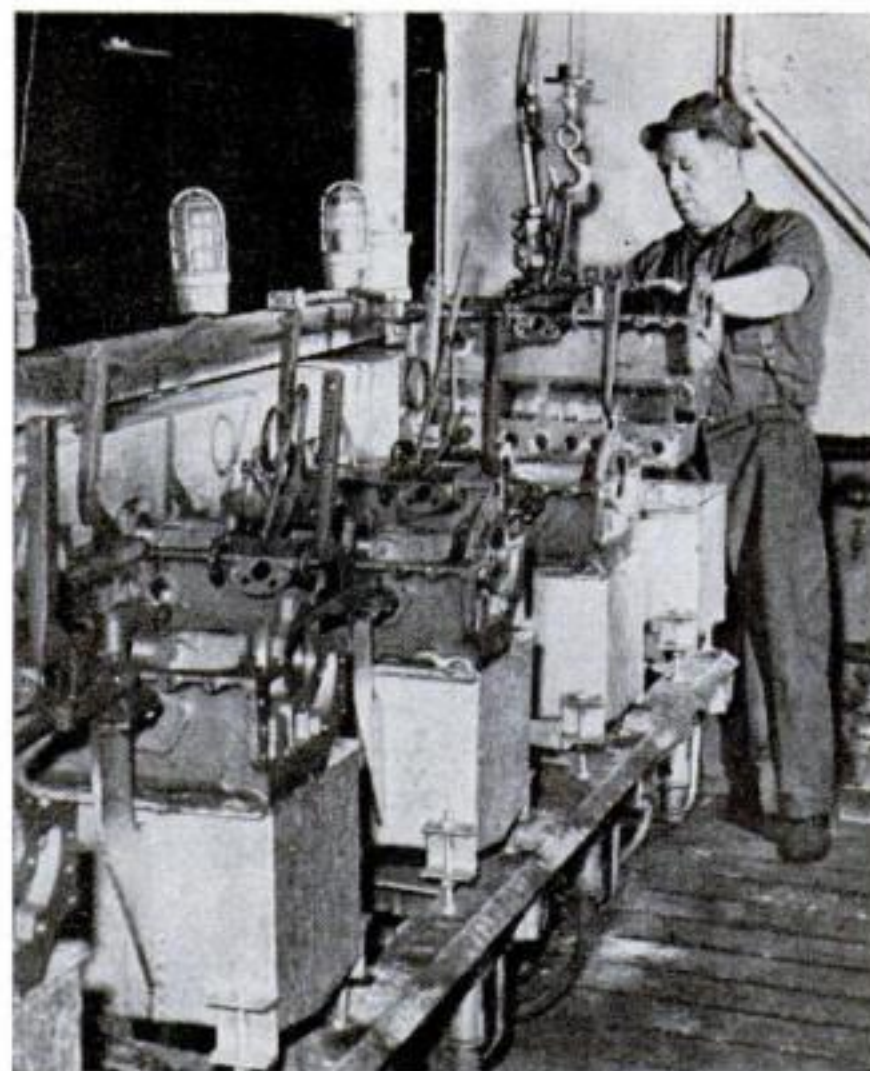
WARREN WASHERS CO., DEPT. 52
70 Medbury, Detroit 2, Mich.
Enclosed \$4.95 for one set of Warren Washers, postpaid.

MY ARBOR
SIZE _____

NAME _____

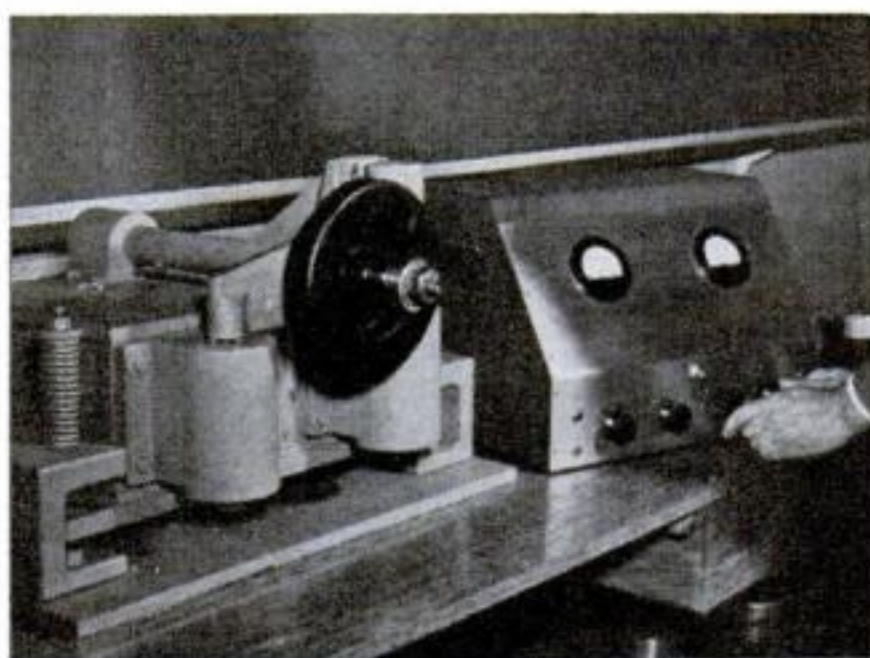
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Bath Toughens Engines

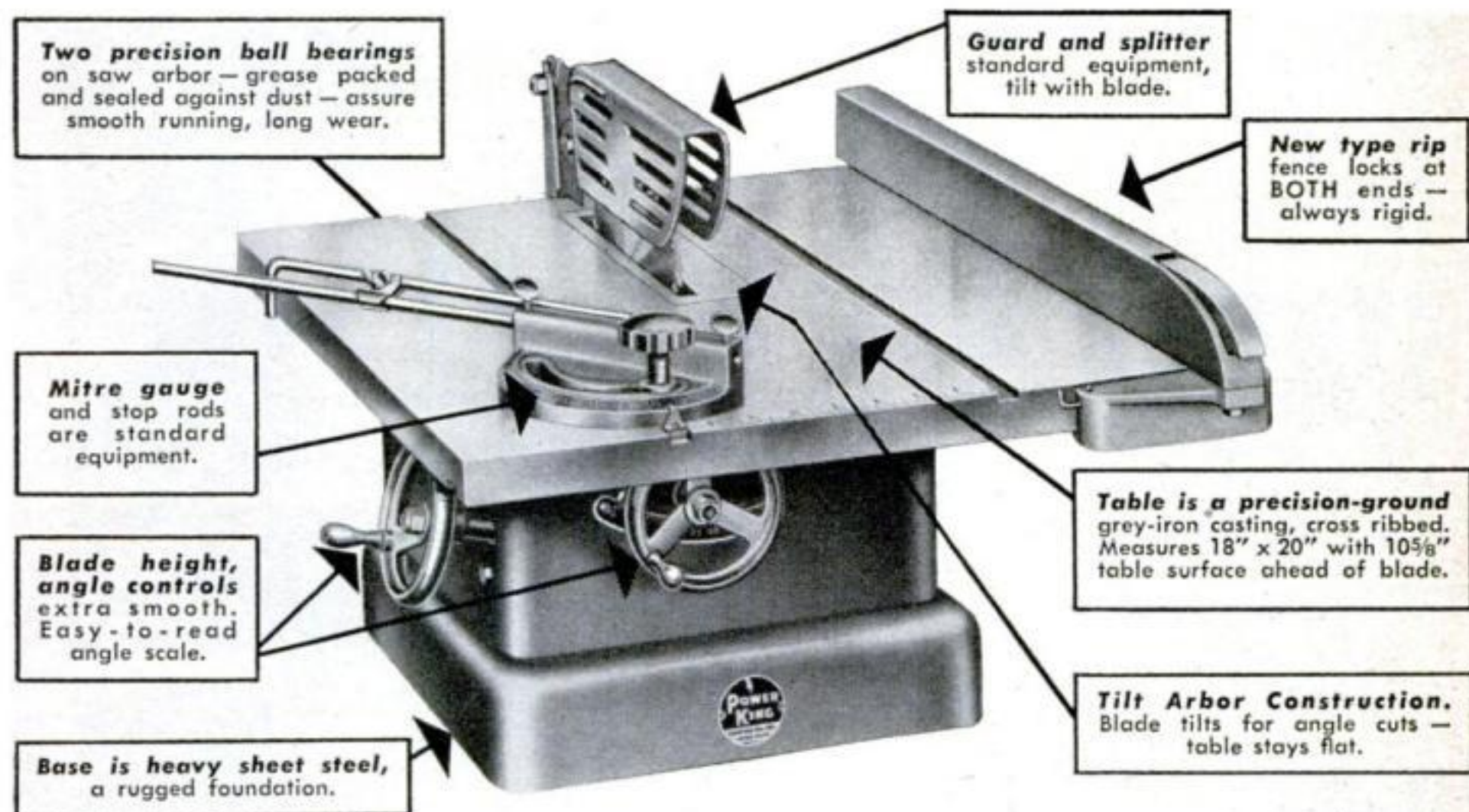
ENGINE blocks for new Dodge cars are shown being dipped into tanks containing a chemical solution that deposits an oil-absorbing coating on the cylinder walls to improve lubrication and prevent scoring. The process, electrically timed, etches minute pockets in the metal and fills them with crystals of manganese iron phosphate.



Magnets Imitate Pistons

THE dark wheel in this picture is a crankshaft-vibration damper used in Ford engines. Because it works in a sealed bath of oil, the device was hard to test in operation. Now that's done by the apparatus in which it is mounted here. This jolts and twists the damper with electromagnets and notes its behavior on the dials at right.

LOOK at the EXTRA-VALUE Features of this **POWER KING** 8" Tilt/Arbor Saw



Use It To Save Many Dollars This Year

It beats hand sawing a mile — makes your workshop time doubly productive — to install a fast accurate tilt/arbor saw. Tables, chairs, cabinets, cupboards, shelves... the list is almost endless of the ways *you* can save money with your home shop.

But it takes a *good* saw to make the greatest savings — one whose accuracy can always be depended upon — one that's built to help you do a "professional" job on every project and give you a lifetime of service. You'll see for yourself that Power King is such a saw when you compare it with other 8" saws.

First, notice the *bigger* table and its *precision-ground grey-iron* surface. Work slides *smoother* on it. Note the rugged *full-size* base. And on the Power King the saw blade *tilts* for angle sawing. The table is *always* flat in the safest position for use. The blade cuts 2 5/8" deep.

Take particular notice of the new type rip fence. It's an accuracy feature and time-saver you'll always appreciate — extends clear across the table, locks securely at *both* ends, releases instantly to lift off or position.

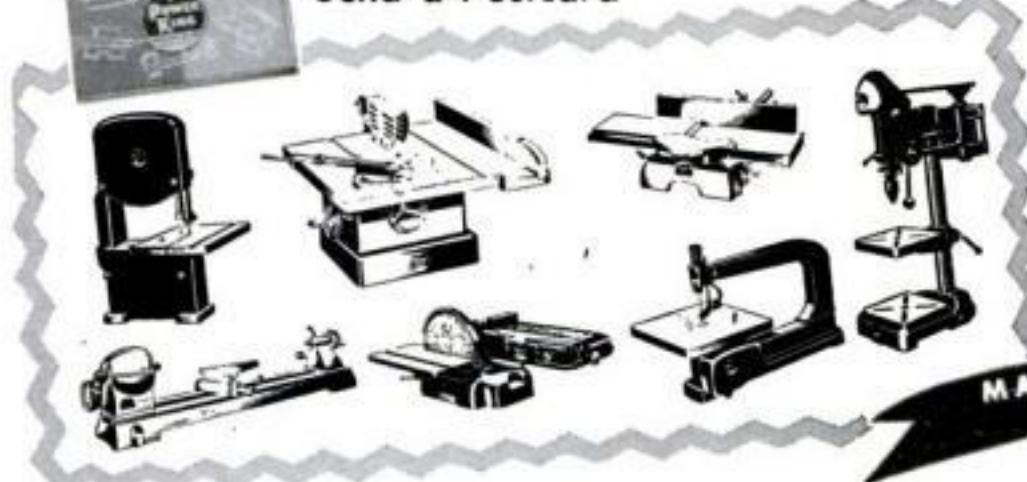
The bearing construction also adds to Power King's extra-value. The saw arbor runs on *two* *precision ball bearings*, grease-packed and sealed against dust and dirt. Such wear-resisting construction assures long accurate service with a Power King.

Yes, in every way, the Power King 8" saw can do a better job for you in your shop, and it's a low cost tool. Send a postcard for full construction details and the name of your nearest Power King dealer.



**NEW! FREE CATALOG SHOWS
ALL 8-POWER KING TOOLS**

Send a Postcard



ATLAS PRESS Company

1242 N. Pitcher St., Kalamazoo, Michigan



**MATCHED PRECISION TOOLS FOR
WOODWORKING AND METALWORKING**



**THE GIFT
THEY ALL
WILL USE!**

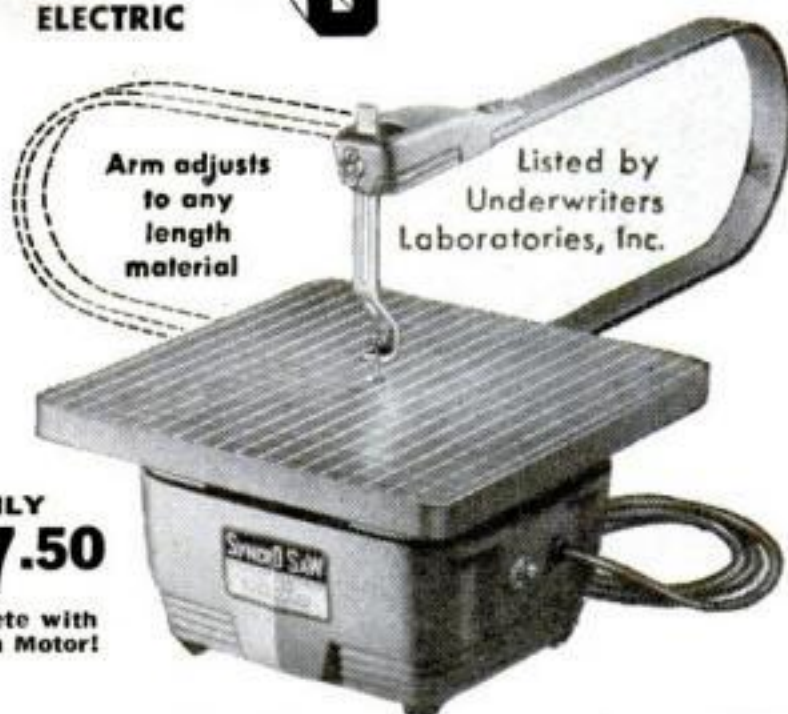
Dad will use SYNCRO for intricate scroll work, what-nots, book ends, other useful articles. Mom will use it to make lapel pins, saw frozen meat, etc. Here is the PERFECT family Gift! Ask your favorite dealer today for SYNCRO Safe Power Saw!



So SAFE children may use to make models, toys, cardboard cut-outs, etc.

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ELECTRIC

SAFE POWER SAW



ONLY
\$17.50

Complete with
Built-in Motor!

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Lives Here

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JOHN SMITH

Yes, here's the ONLY power saw in the world EVERY member of the family can SAFELY use... whether they're "making things" for personal pleasure or to sell for extra income! Syncro is used in schools, hospitals, and thousands of apartments, houses in towns, on farms. NO MOTOR TO BUY! Plug into any 50-60 cycle, 110-120 volt A.C. only outlet—and saw! Portable. Cleanly cuts wood, thin metal, plastics. Arm adjusts to cut any length material. New Off-On switch. Quiet operating. Enjoy a Free Trial at dealers now. Still only \$17.50 (\$18.50 direct from factory, postpaid, if no Syncro dealer near). Full-size Pattern No. 74 (for House Numbers, Name Plates, Signs) FREE with your SYNCRO. (For Pattern No. 74 only, send 25c to Syncro Pattern Division, Dept. M-128, Box 215, Pleasantville, N. Y.) Or rush post-card to factory for Free Syncro Circular!

SYNCRO CORPORATION, Dept. M-128, Rochester, Michigan

MAKE CUT-OUT FREE AT DEALERS!

Paste figure of "Miss Syncro" (or any snapshot) on 1/4" plywood or 1/2" soft wood, take to nearest Syncro dealer, present Coupon below, and cut out a wooden silhouette FREE—take home for mantel, dresser display.

(DEALERS! Write, wire for "Special Dealer" Offer!)

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MR. SYNCRO DEALER: This entitles bearer to saw out, on your SYNCRO SAW, FREE, one snapshot or picture bearer has pasted on 1/4" plywood or 1/2" softwood—or personally try SYNCRO at store using material you furnish.

SYNCRO CORPORATION, Rochester, Michigan



Machine Cleans Roadbed

DIRT that sifts into the rock ballast under railroad tracks has to be cleaned out now and then to keep the roadbed springy. Once a job for picks and shovels, this now is done faster by machines. Newest of these is the British ballast cleaner shown in action above. As it moves along the rails under its own power, steel claws on an endless chain—shown close up in the lower photo—dig both rock and dirt from under and between the ties. The dirt, jogged loose on the inclined conveyer, is dumped beside the track, along with dust and chips worn from the ballast. Larger pieces of rock then are put back in place on the roadbed. The machine, operated by eight men, can cover 130 yards of track an hour and dig to a depth of three feet.



**DELTA
MILWAUKEE**

Homecraft 4-in. Jointer, No. 37-110 — for forming straight, true edges without the drudgery of hand planing...\$32.95

Homecraft 10-in. Band Saw, No. 28-110 — for straight or curved cuts...\$39.95
Lamp extra.

Homecraft 11-in. Drill Press, No. 11-120 — 7 tools in 1. For drilling, shaping, routing, carving, sanding, grinding, mortising...\$43.95
Motor Extra.

THE Gift of Happiness:

Homecraft® POWER TOOLS

(Made by Delta)

It's sure to thrill him (or her) — your gift of one or more Homecraft Power Tools. It's a gift that provides years of fun and healthful relaxation.

These popular tools are easy to use. And the range of jobs you can do on them is truly amazing — especially when you add the many attachments that only Delta offers in complete variety.

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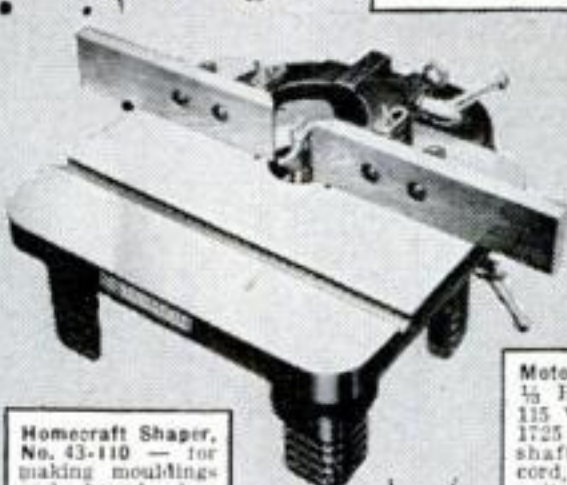
Look over the selection of Homecraft Power Tools at your dealer's store — and ask about the time-payment plan. ...This Christmas, put happiness in his (or her) hands.

Hinting Season Is Here

If you happen to read this ad first, leave it around where the right people will see it.



Homecraft 8-in. Circular Saw, No. 34-110 — for ripping or cross-cutting and making mouldings \$36.95



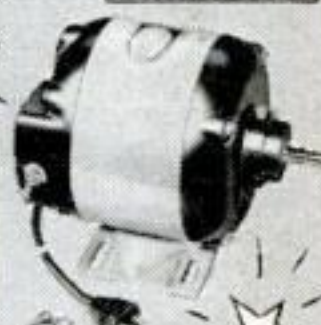
Homecraft Shaper, No. 43-110 — for making mouldings and shaped edges...\$49.95



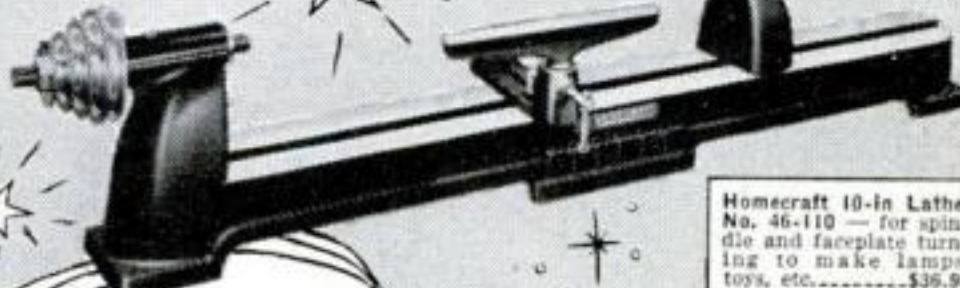
Homecraft 16-in. Scroll Saw, No. 40-110 — for all curved sawing, in making toys, shelves, etc. Also for filing and sanding...\$31.95
Motor, belt, and lamp attachment extra.



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Motor No. 60-030 — 1/2 H.P. Single Phase, 115 V., 60 cycle, A.C., 1725 r.p.m., 1/2" single shaft, complete with cord, plug, and toggle switch. This is a split phase sleeve-bearing motor for light use \$16.45



Homecraft 10-in. Lathe, No. 46-110 — for spindle and faceplate turning to make lamps, toys, etc...\$36.95

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General Sales Office • 6 NORTH MICHIGAN AVENUE CHICAGO 2, ILLINOIS

**Homecraft®
POWER TOOLS**

All tool prices shown are without motors and lamp attachments. Prices subject to change without notice.



Send 10¢...
— for woodworking handbook and catalog of Homecraft Power Tools.

Made by Delta

Homecraft Power Tools are made by the world's leading manufacturer of light power tools, the same company that makes the famous Delta® Power Tools. Delta tools are famous for quality, dependability, and safety. They are widely used in industrial plants, schools, and in home shops of people who want the best in heavy-duty quality.

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Enclosed is 10¢. Send me copy of new Homecraft Catalog HC-1.

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You can get a professional finish on those jobs for the kids! For a slick, smooth finish that takes paint, lacquer or varnish perfectly, use Plastic Wood as your filler. Repairs such as cracks, gouges or loose joints are quickly mended and the toy is back in apple-pie order! *Handles like putty—hardens into wood!*

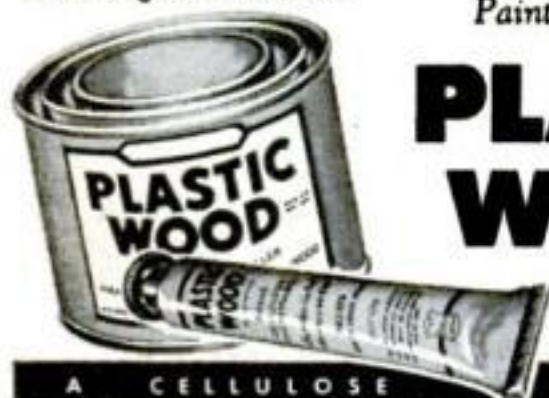
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Tube or Can

A CELLULOSE FIBRE FILLER



Accordions Use Plastic

THESE new accordions are the first to be made entirely of plastic. The reed plate is molded in a single piece, and largely as a result of this simplification each instrument has only a tenth as many parts as a comparable one of conventional design. The smaller model plays a scale and a half on 12 reeds controlled by six keys. The larger one has 20 reeds and 10 keys. Both are made by the Magnus Harmonica Corp., of Newark, N. J.



Plastic Doll Looks Alive

PRECISE molding and careful spray painting give this all-plastic doll a lifelike appearance. Tiny fingers, for instance, are separated—not bunched—and faithfully reproduced down to such details as nails, knuckles, and palm lines. Practically unbreakable, the new doll is made by the Ideal Novelty and Toy Co., of New York.

Bargains FOR HOBBYISTS AND EXPERIMENTERS

ALL QUANTITIES LIMITED SUBJECT TO PRIOR SALES

HEATHKIT 3 TUBE ALL WAVE RADIO KIT

No. K1. An Ideal Beginners Radio Kit covers 550 to 6000 KC including Broadcast, police, aircraft, amateur marine, and foreign broadcasts. All parts including 3 tubes supplied. 110V 60 cy AC. Transformer operated, calibrated dial complete instructions for assembly. Operates loud speaker (not included). Excellent boy's gift. Ship. wt. 3 lbs. Loud speaker 2½" PM (extra).....\$1.95 Headphones (extra).....\$1.00



\$8.75

BC 645 GENERAL ELECTRIC TRANSCEIVER



No. 201. Complete 15 tube transmitter receiver. Ideal for new citizens band 460 Mc for communication between office and car, home, boat, etc. Conversion

article in August ELECTRONICS Magazine. Brand new in original G.E. cartons with tubes. Add postage for 25 lbs.

\$19.50 2 FOR \$35.00

ACCESSORIES FOR BC 645

PE 101C Dynamotor for car use. . . \$3.95

110V 60 cycle power supply for home or office use. . . \$14.50

HOME WORKSHOP GRINDER KIT

No. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotor. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping weight 6 lbs.



\$3.95

ARMY ELECTRONIC ALTIMETER



\$34.50

complete with 14 tubes, controls, plugs, antennas and instruction manual. Shipping wt. 87 lbs.

TANK TRANSMITTER POWER SUPPLY

No. 223. Army PE125 power supply provides 500 volts at 160 MA from 12 or 24 Volt storage battery. Heavy duty unit with filters starting relays, fuses, tubes, and diagram. Shipping wt. 73 lbs.



\$12.95

T 32 TABLE MICROPHONE



No. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs. \$2.95

INTERPHONE 2 WAY CALL SYSTEM KIT

No. 1P1. Saves many steps between house and barn, tenant house, workshops, etc.; can be used to watch baby from neighbors. Uses 2 wires and will operate up to 1-5 mile. More than one remote can be used. Kit is complete with tubes, one master, one remote speaker and detailed instructions. Shipping weight 5 lbs.



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ASTROGRAPHS WITH CASE



Only \$3.95

No. 259. New B29 navigation instrument which can easily be used to make a good contact printer, strip map holder, etc. The plywood case 14½" x 11" x 10" high is perfect as a tool kit, camera, projector case or for building a portable phonograph picnic kit, make up case, etc., has leather handle reinforced covers, 8 covered compartments in bottom. Cost Gov't \$125.00. Add postage for 20 lbs.

GN 58

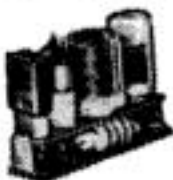
GENERATOR

No. 275. Makes excellent home lighting plant, operated by wind propeller, waterfall, gas engine, or hand crank. Reduction gear allows full output at slow speed supplies 6 volts at 2.45 amp., 425 volts at .115 amp. New. Add postage for 28 lbs.



\$7.95

BC 746 TUNING UNIT



\$1.00

No. 257. Transmitter Receiver Tuning Unit from Army Walkie Talkie. Containing coils tuning condenser, transmitter crystal sockets, etc., excellent for building amateur station. Shipping wt. 1 lb.

METER SPECIAL

No. 237. Beautiful Dejur 3" Square Precision Milliampmeter 0-800 MA range, 0-10 MA basic movement. Probably the best buy ever offered in a war surplus meter. Shipping wt. 1 lb.



\$2.95

BENDIX

DIRECTION FINDER LOOP



\$9.95

No. 219. Brand new loop excellent for aircraft or boat direction finder. Also useful as radio aerial to eliminate local interference. Rugged army construction. Shipping wt. 8 lbs.

G.E. 50 AMP CIRCUIT BREAKER

No. 204. New General Electric 50 Amp. 220 Volt AC circuit breakers. 100 Amp. when used on 110V. Add postage for 4 lbs. \$2.95, 3 for \$7.50



MINIATURE ELECTRIC MOTOR



\$2.95

No. 211. Tiny Delco motor only 1" x 1¼" x 2" 10,000 RPM. Operates from 6 to 24V. Excellent for models. Add postage for 1 lb.

HEATHKIT HIGH FIDELITY AMPLIFIER KIT

No. A2. A truly fine 110V 60 cy transformer operated High Fidelity Amplifier Kit. Ideal for reproducing quality music at home, churches, mortuaries, outdoor gatherings etc. Output over 10 Watts. Complete with all tubes (push pull circuit) transformers, punched chassis and detailed assembly instructions. Shipping weight 20 lbs. High Fidelity 12" P.M. Speaker for above \$6.95 Mahogany speaker cabinet size 14½" x 14½" x 8" for above speaker. \$8.75



\$14.95

BC375 TRANSMITTER TUNING UNIT



\$2.49

No. 203. A beautiful Army Tuner containing 3 precision variable condensers, tank coils, switches, vernier dials, worth over \$30.00. The best buy in surplus. Shipping wt. over 20 lbs.

FM PUSH BUTTON TUNER

No. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs. **\$2.50**



G.E. 1000 VOLT 350 MA DYNAMOTOR



\$5.95

No. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs.

DM-36 DYNAMOTOR

No. 215. Western Electric 24 Volt input, 220V at 60 MA out. With filter assembly. Ship. weight, 6 lbs. **\$2.95**



POWER TRANSFORMER - SPECIAL



\$3.95

No. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.C.T at 220 MA, 6.3V. at 4.5A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping 3 FOR \$9.95 Weight 11 lbs. each.

HEARING AID HEADPHONES

No. 216. Hearing aid type, comfortable, keeps out outside noise, one of the Army's best types. Add postage for 2 lbs. \$1.00



THE NEW 1948 HEATHKIT 5" KIT OSCILLOSCOPE



\$39.50

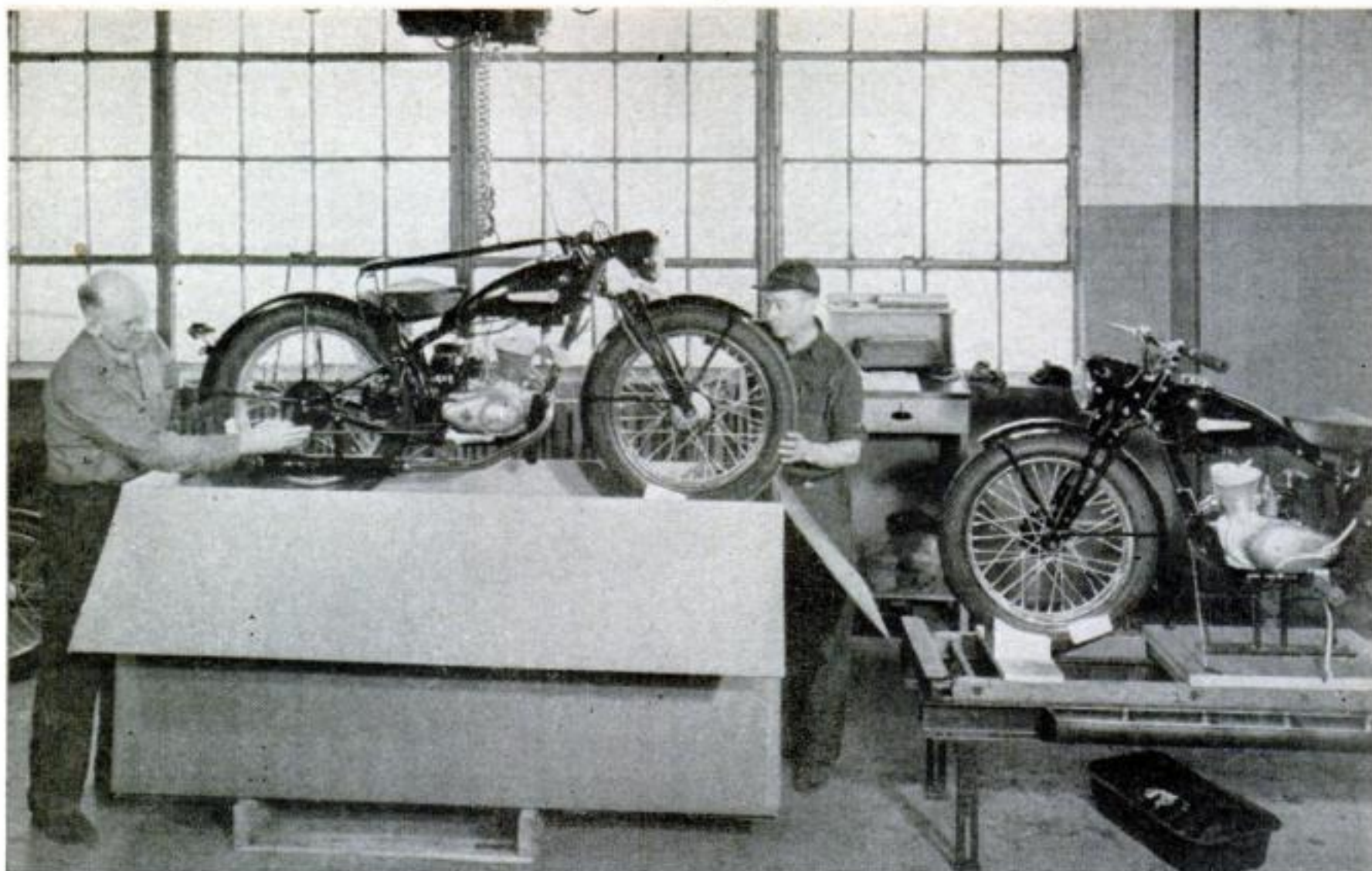
No. 03. Complete kit to build a beautiful 5" oscilloscope. Ideal for studying and servicing television and FM radio. 6 tubes including 5BP1 cathode ray tube. 1500-Volt power supply operates from 110-V 60 cy A.C. Has compensated vertical and horizontal amplifiers and 15 cy to 30 KC sweep generator. Detailed instructions make assembly easy. Shipping weight 35 lbs. Nothing else to buy.

HOW TO ORDER

HEATH COMPANY

Give part number and description. Add postage for weight shown. No orders under \$2.00. We will ship C.O.D.

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Paper Box Packs 170-Pound Motorcycle

WHEN you can ship a 170-lb. motorcycle in a paper box, it's quite a box. Largest of its kind, this corrugated strawboard contain-

er is 80½ in. long, 24 in. wide, and 36 in. high. Made by the Gaylord Container Corp., it supports 350 lb. per sq. in.

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Use it for:
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Complete with pulley and mounting brackets, ready for use.

Belt Driven Centrifugal Pump

An extraordinary value for all types of intermittent or continuous pumping in the home... farm... factory. Built to exact specifications of Packard Motor Car Co. for use in Rolls-Royce Merlin Aircraft Engines. May be run with electric motor, gas engine or power take-off on tractor. Delivers up to 25 gallons a minute with ¼ H.P. motor; 80 gal. a min. with one H.P. motor. Will deliver up to 44 ft. head or 25 ft. suction. Use 1" outlet hose; 1" or 1½" inlet hose (recommended).

Complete Engineering Reports and Operating Instructions Free with Pump

Has cast aluminum housing, accurately machined 5" bronze impeller; 3½" V belt pulley and mounting brackets. Shaft rotates on ball bearing; has grease gun fitting.

Original cost approx. \$88.00. Shipping weight 10 lbs. A REAL BUY.

\$21.50
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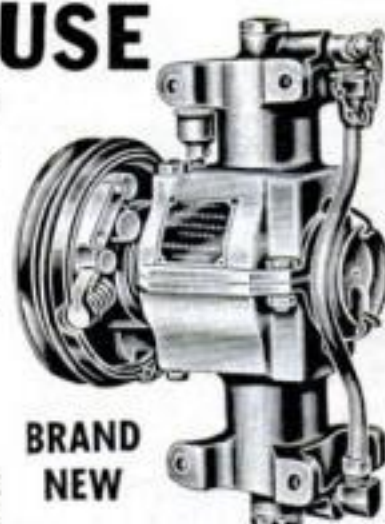
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War Surplus Bargain Special!

2 CYLINDER PISTON TYPE

Ideal For

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FOR THE HOME... FARM... FACTORY.

Designed for automotive truck or tractor mounting. Can be run off fan belt or power takeoff. Comes with automatic clutch. Can be installed for use on: farm trucks, jeeps, tractors, tire or garage service trucks, contractor or road building machinery, pneumatic devices, etc.

CAN BE OPERATED WITH ½ H.P. OR MORE ELECTRIC MOTOR OR EQUIVALENT PORTABLE GAS ENGINE.

Light weight, compact and versatile unit... delivers "oil free air"... simple in operation; requires minimum of maintenance; operates under all climatic conditions; suggested operating pressure 75 P.S.I.; equally efficient operation in either direction of rotation; approx. displacement 3.27 CFM at 600 RPM, 6.54 CFM displacement at 1200 RPM; 2" Bore—1½" Stroke. Overall dimensions: width 9", height 11½", depth 6½"; approx. wt. 23 lbs.

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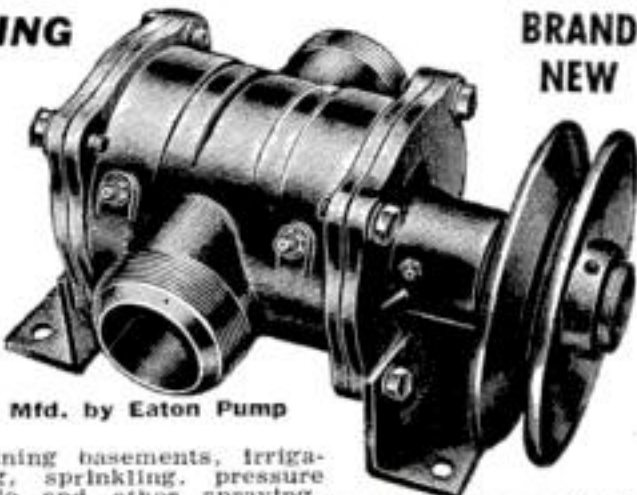
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Positive
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Mfd. by Eaton Pump

Perfect for draining basements, irrigation, fire fighting, sprinkling, pressure booster, insecticide and other spraying, fuel transfer, stock watering, industrial pumping, deep well jet pumping and home water systems. Rated 25 ft. suction and 100 ft. head pressure at 65 gallons a minute with 1725 RPM at one H.P.

COMPLETE ENGINEERING REPORT AND INSTRUCTIONS FREE WITH PUMP

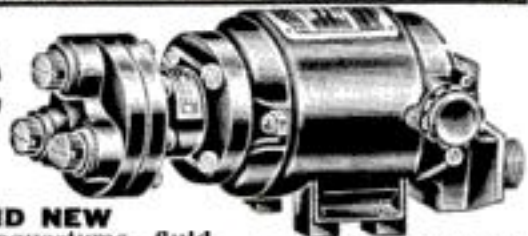
Supplied with mounting brackets and 5" V belt pulley, ready for instant use. Standard 1 1/2" inlet and outlet pipe thread. Dimensions: 9 1/2" x 7 1/4" x 4 1/4". Ship. wt. 18 lbs. A \$142.00 value.

\$32.50
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Chicago

SELF-PRIMING ELECTRIC PUMP

COMPACT—BRAND NEW

Applications: oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc. Motor mfd. by Black & Decker; double ball bearing series wound, continuous duty, 1/30 H.P., electric motor, rated 12,000 R.P.M. Transformer included for use on 110 V AC current. Also applicable for 24-32 V DC. Pump mfd. by Weldon Tool Co. with standard 1/4" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder. Overall dimensions: 7 3/4" long x 3 3/4" wide x 3 1/4" high. Approx. wt. 5 lbs. \$51.00 value.



\$12.95
Postpaid

BRAND NEW THREE-IN-ONE MULTI-PURPOSE PUMP

Three independent pump sections running off of one shaft, for single or multiple pumping. Use one as a vacuum pump capable of drawing 25 inches of mercury. Use one or two as a liquid pump for hydraulics, insecticide spraying, pond and basement draining, stock watering, aeration, etc.

Supplied with 4" V belt pulley. Inlets and outlets 3/8". Easy to use—foot mounting. Constructed of bronze and aluminum to exacting ordnance specifications. Dimensions: 6"x5"x4 3/8". Ship. wt. 10 lbs. Government acquisition cost \$74.00. YOUR PRICE...

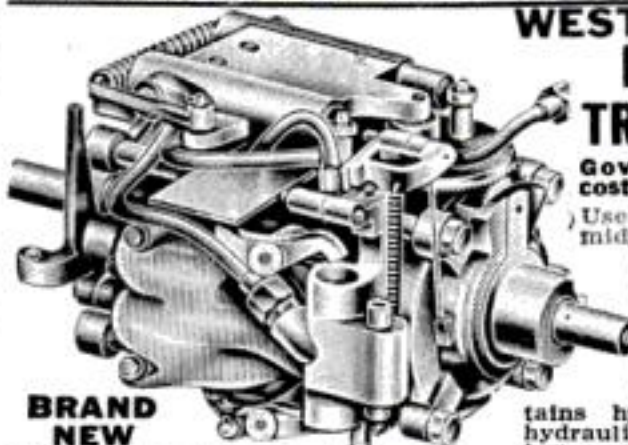


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WESTINGHOUSE HYDRAULIC TRANSMISSION

Gov't. Acquisition cost \$300.00

Use it on chain saws, midget autos, lathes, drills, power machinery, chucking machines, farm machinery, potters' wheels, tractors, trucks, etc. Ideal as hydraulic torque converters. Contains hydraulic pump and hydraulic motor; has reversing controls. Designed for



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NEW

use on 2 ton 40 mm anti-aircraft guns; contains 10 ball bearings and high quality precision workmanship, made to exacting specifications of ordnance department. Overall dimensions: 12" long x 5 1/2" wide x 6 1/2" high. Ship. wt. 19 lbs.

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grams, photographs and instructions—FREE with each hydraulic order. FREE: New, 20-page illustrated Hydraulic Manual featuring dia-

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AIR OR OIL HYDRAULICS



• Use hydraulics on air-bor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship.

- 1 Double action, 1 1/2" bore, 5" stroke, will lift 1760 lbs. in one second with Vickers MF6 Pump. Wt. 3 lbs. A \$35.00 value. **\$8.95** post-paid
- 2 Double action, 1 1/2" bore, 9" stroke, will lift 1760 lbs. in one second with Vickers MF6 Pump. Wt. 4 lbs. A \$45.00 value **\$10.95** post-paid
- 3 Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1 1/2" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Vickers Pump.) Wt. 8 lbs. A \$55.00 hydraulic cylinder value for only. **\$12.95** post-paid
- 4 Double action, 2 3/8" bore, 8" stroke. (Will lift 4400 lbs. in one second with Vickers Pump.) Will withstand 1500 P.S.I. against wall. Wt. 7 lbs. A \$65.00 value **\$14.50** post-paid
- 5 Double action, 3" bore, 10 1/2" stroke. All steel hydraulic cylinder, will lift up to 12,000 lbs. (7000 lbs. in 3 seconds with Vickers Pump.) Complete with fittings. Wt. 12 lbs. A \$78.00 value **\$19.50** post-paid
- 6 Double action, 3 1/2" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Vickers MF6 Pump.) Complete with fittings. Wt. 15 lbs. A \$92.00 value **\$22.50** post-paid

HYDRAULIC CONTROL VALVES

BRAND NEW



- 1 Four-way control valve for use with two hydraulic double action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Brand New. Ship. Wt. 6 lbs. A \$60.00 value. **\$10.95** post-paid
- 2 A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand New. Ship. Wt. 8 lbs. A \$75.00 value. **\$14.95** post-paid



VICKERS MF6 Hydraulic Pump or Motor

Compact, powerful, rated 1,000 P.S.I., .507 cu. in. per revolution, 8 gal. per min. at 3750 r.p.m. Change rotation by reversing flow. Delivers up to 6 H.P. BRAND NEW. Wt. 4 1/2 lbs. \$60.00 value for . . .

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Brand New CHECK and RELIEF VALVE. Adjustable for any pressure **\$2.95** post-paid



VICKERS HEAVY DUTY HYDRAULIC PUMP

BRAND NEW

For tractors, bull-dozers, construction machinery, lift trucks, industrial applications, etc. Used on Ross Carriers. Delivers 18 gal. per minute at 1000 P.S.I. at 1200 R.P.M. using 10 H.P. Has 1 1/2" intake; 1 1/4" outlet; threaded and keyed 3/4" shaft for direct or pulley drive.

Wt. 40 lbs. Dimensions: 5 3/4" diameter, 7 1/2" high. Original value \$148.00. NOW **\$39.50** F.O.B. Chicago

VICKERS HEAVY DUTY HYDRAULIC CONTROL VALVE

Brand New. This Vickers heavy duty 4-way control valve, Part C-2330, is ideal for use with the Vickers Heavy Duty Pump for double action cylinders. Has built-in relief valve with 50 to 1000 lbs. per sq. in. overload adjustment; max. capacity 24 GPM; pressure inlet connection from pump 3/4" pipe thread; cylinder connections 3/4" pipe thread; discharge connection to tank 1 1/4" pipe thread. Over. dimen.: 8 3/4" W x 10 7/8" L x 7 3/8" H. Ship. wt. 54 lbs. ORIGINALLY COST MANY TIMES MORE. NOW **\$24.95** F.O.B. Chicago

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Streamline Your Car with SANDEE FENDER SKIRTS... \$17.20 pr.

Sparkling beauty you'll like. Constructed of heavy gauge body steel, finished in prime, perfect fit.



For Ford, Chev., (except Fleetline), Merc., Plym., De Soto, Chrys., Dodge, Kaiser, Frazer, Buick (except 42-48 Super), Olds. Series 60 & 70, 1937-40, Pont. 6 1939-40.

Beautify your car... bring out the flowing lines inherently designed there.

for AMAZING
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DIXIE-WESTERN DUAL INTAKE MANIFOLDS for V-8 FORDS AND MERCURYS \$15.00

Gas Line and Throttle Kit \$2.50 extra. Chrome Plated Velocity Stacks \$3.00 pair. By test—increased acceleration by 26%—increased power and speed by 11%. All DIXIE WESTERN manifolds are brightly polished cast aluminum.

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ELECTRIC MOTOR 1/2 H. P. 27 V. D.C. R.P.M. 4000 #750 For intermittent or continuous duty 5/8" SHAFT VARIABLE SPEED MOTOR. Can readily be adapted to 110 V. A.C. or R.E.A. line by simple method of rearranging armature brush leads. **UNUSED \$5.50** instructions included.

LUBE PUMP. New Precision Gear Impeller pump. Pumps liquid up to 3 G.P.M. Pressure up to 200 lbs. per Sq. in. For high vacuum, air pressure, liquids operating units, etc. Size 3 1/2" x 8 1/2" St'd 1/2" Shaft. Complete instructions incl. Ea. **\$4.95**

BRAND NEW WONDERFUL ROTATOR MOTOR For rotating Ham FM Antennas, Turntables, Telescopes, etc. Operates directly on 110 V. A.C. 60 cycles (requires only 12 MFD condenser) 3/4 R.P.M. For operating Ventilating Louvers such as used with Attic Fans, Furnace Dampers or check drafts. Complete instructions incl. Ea. **\$3.95**



NEW CUNO OIL FILTER, aircraft type keeps oil clean without cartridge replacement. For AUTOS, TRUCKS and TRACTORS. Install at home in a few minutes. **STOP CHANGING MOTOR OIL. \$4.95** Instructions incl.

SELSYN CONTROL TRANSFORMER Model #2J1G1, 57.5 V. 400 cycles. Can be used on 115 V/60 cycle A.C. Instructions incl. New. Per pair. **\$2.50**

SPEED REDUCERS, G.E. 10 to 1 ratio, or 5 to 1 Shaft Driven 1 1/2" spline Shaft. 3 mounting holes 5/16". Unused Ea. **\$4.50**

DYNAMOTORS. BRAND NEW. Check list and order now. Input 27 V. D.C. 485 KVA Output 115 V. A.C. Wt. 16 lbs. Ea. **\$4.95**
DYN. new model #23350 Input 27 V. D.C. output 285 V. D.C. Ea. **\$1.35**



VICKERS PUMP. High Pressure Hydraulic pump. Use it for any type liquid pumping job, 400 gal. per hr. at 3750 R.P.M. rated 1000 P.S.I. NEW Only. **\$7.50**

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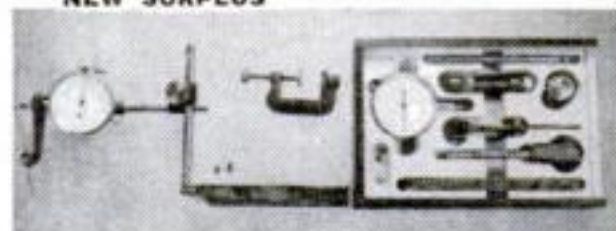
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MAKES SEWING A PLEASURE!

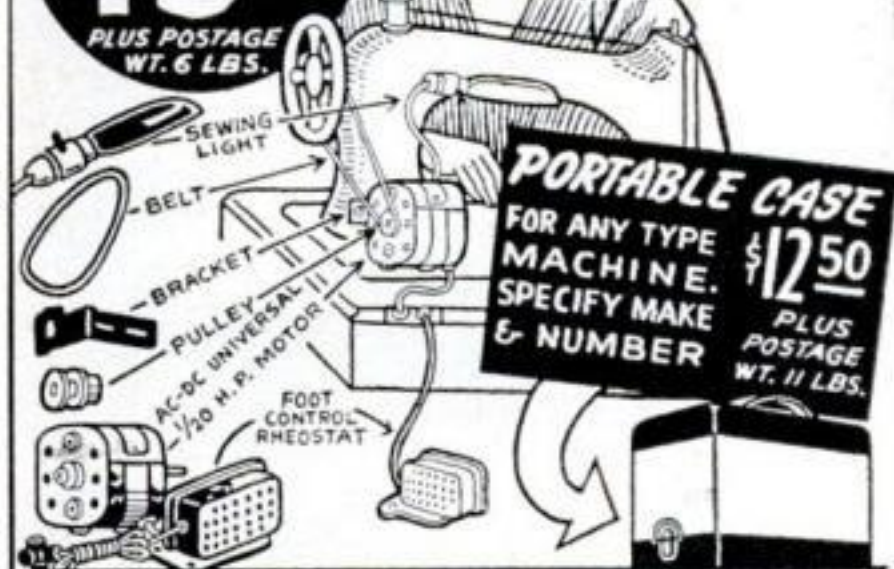
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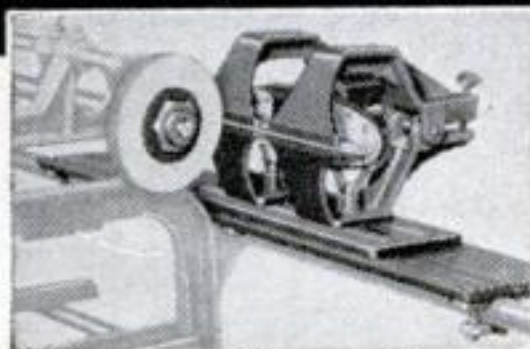
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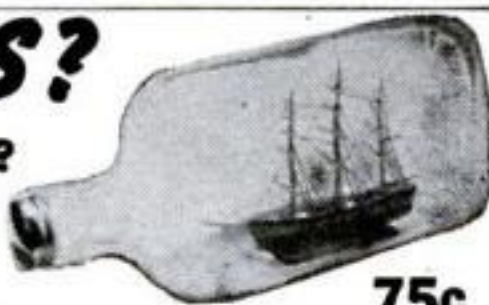
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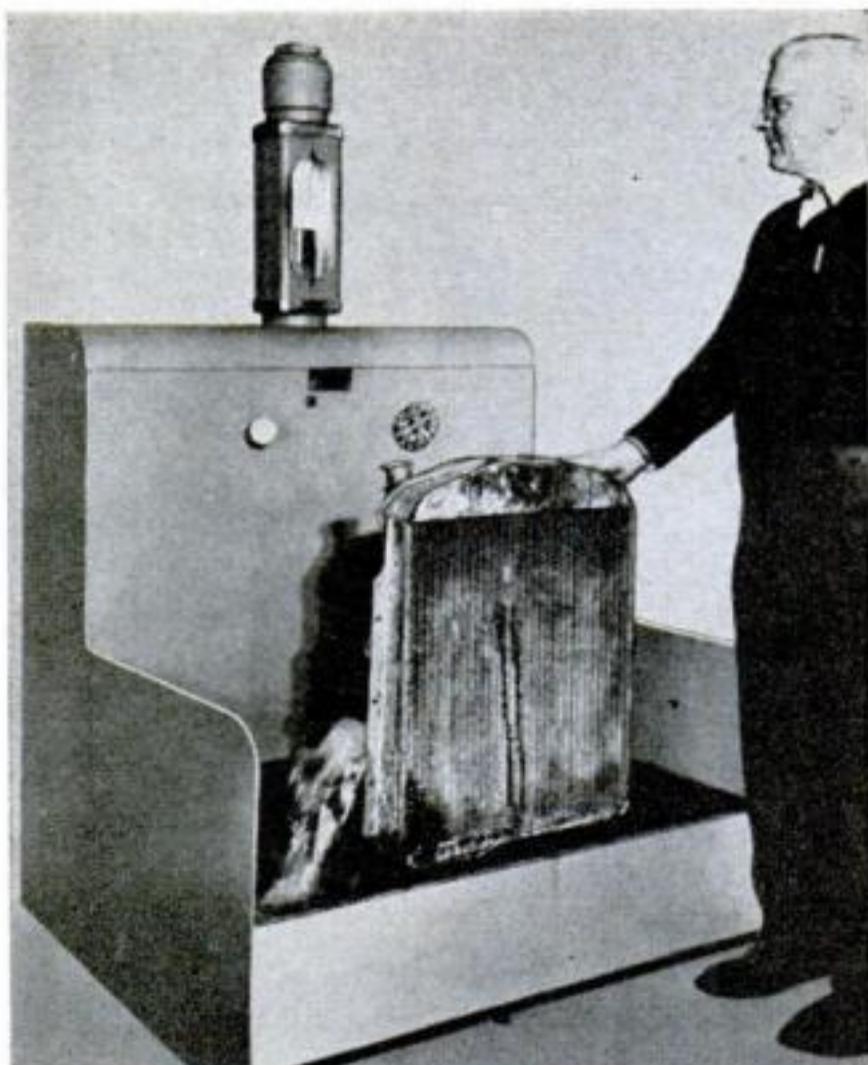
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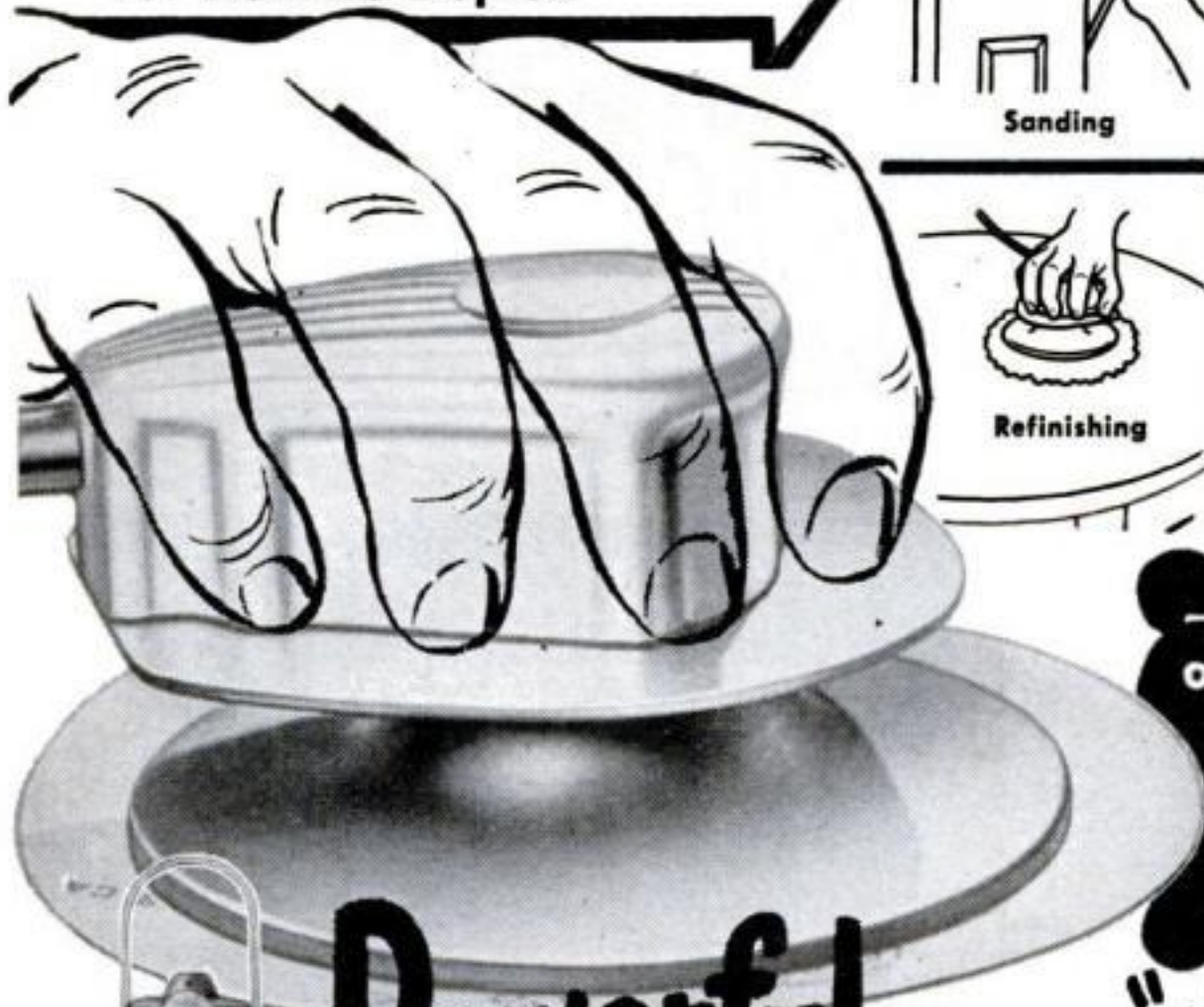
THIS new machine for auto-repair shops tells how badly a radiator is plugged up by pumping water through it and measuring the rate of flow. There's only one hose connection to make, one switch to throw, one valve to control. The meter at the top then shows the result in gallons per minute. Inland Mfg. Co., of Omaha, makes the tester.



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with sanding attachment
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Handy Sandy
sanding
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Here's a low-priced sander and polisher that *really does a job for you!* It's a powerful, practical tool — not just a toy. The rugged 1/14 HP Duplex Grinder motor gives it the punch *you want* on man-sized jobs.

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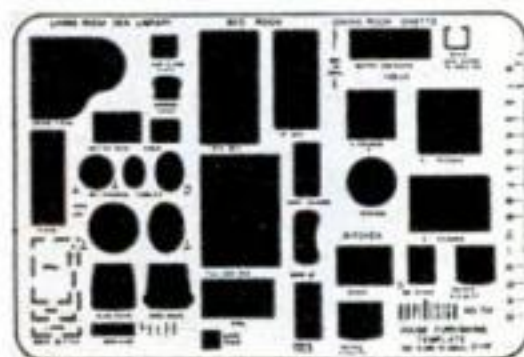
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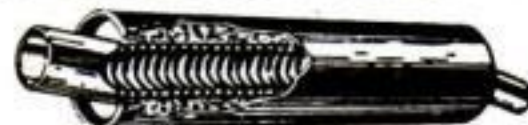
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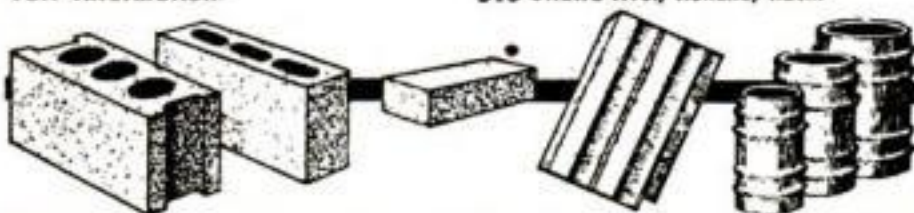
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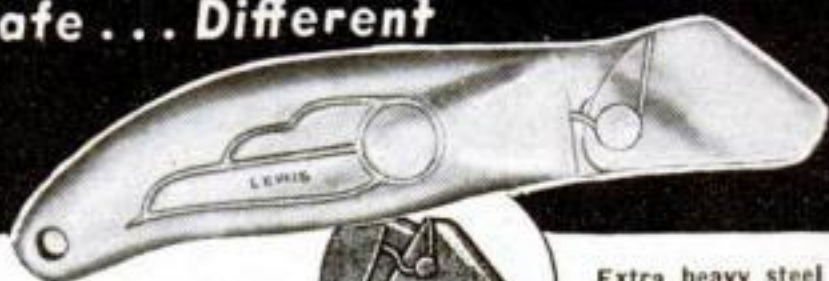
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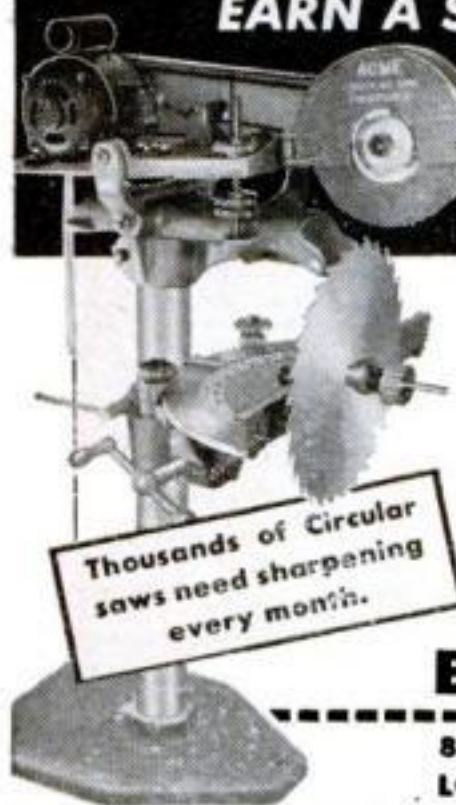


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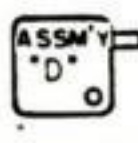
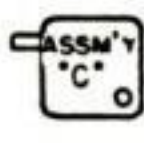
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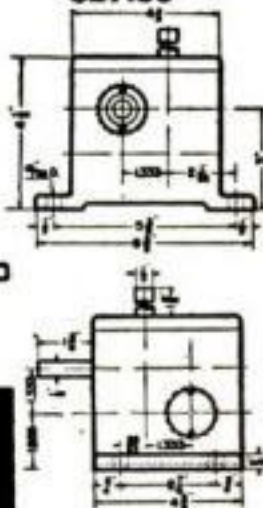


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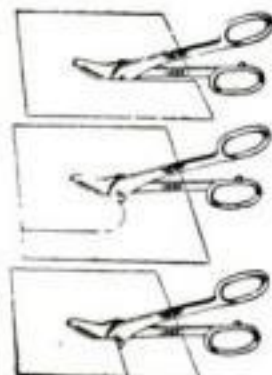


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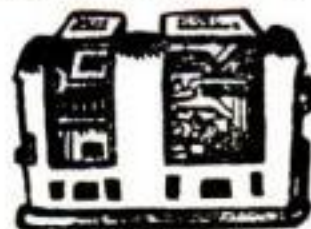
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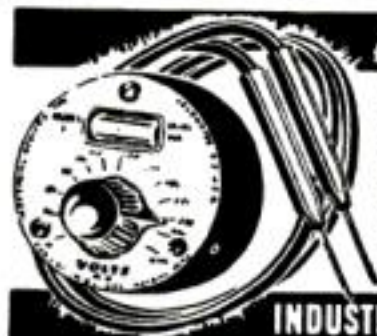
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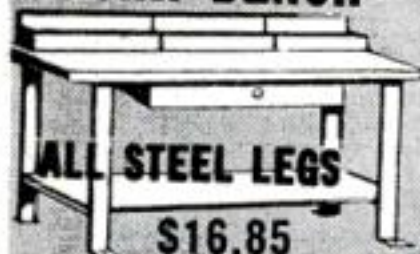


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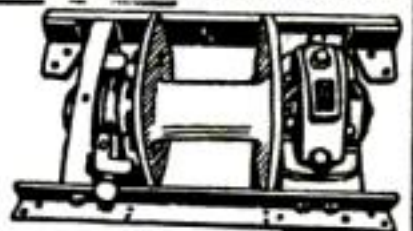


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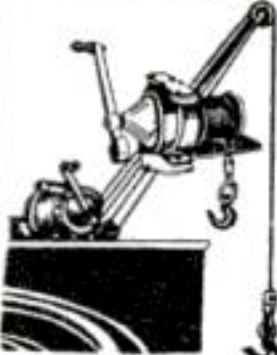
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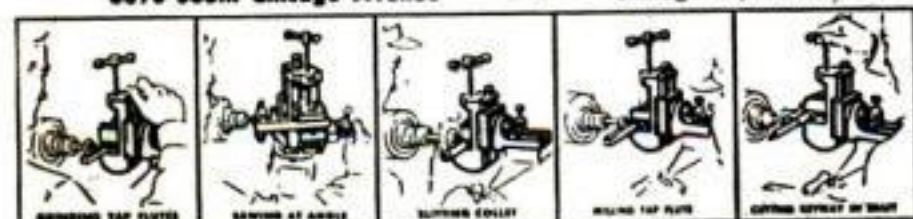
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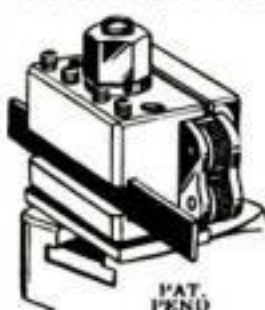
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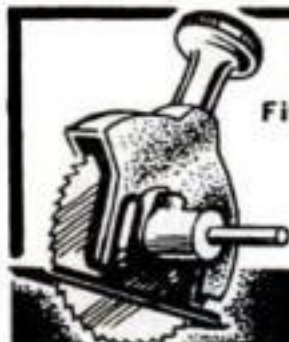
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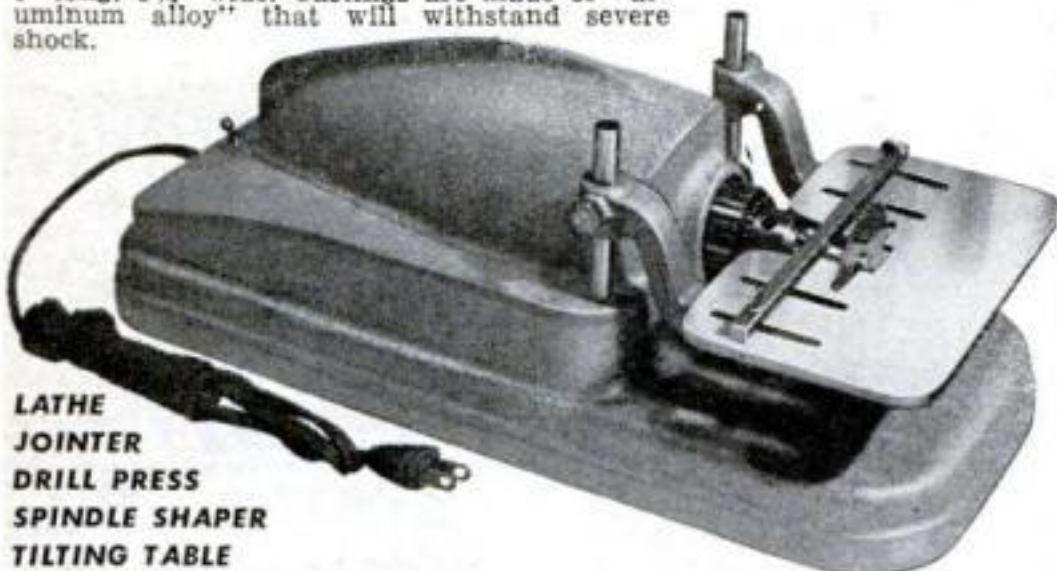
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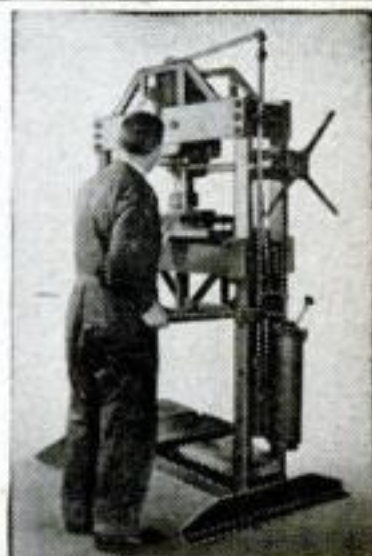


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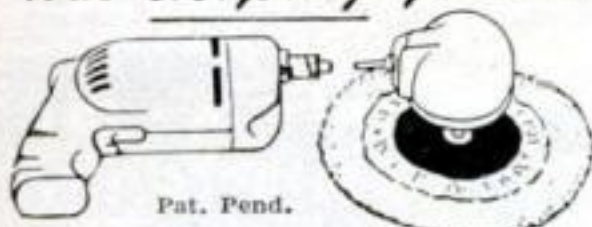


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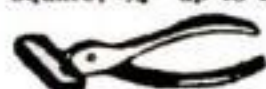
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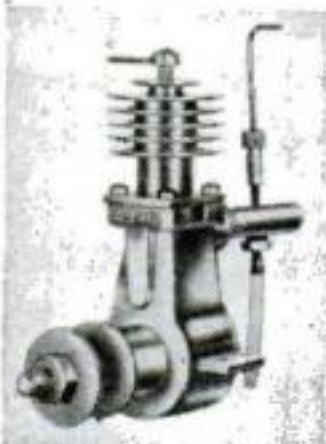
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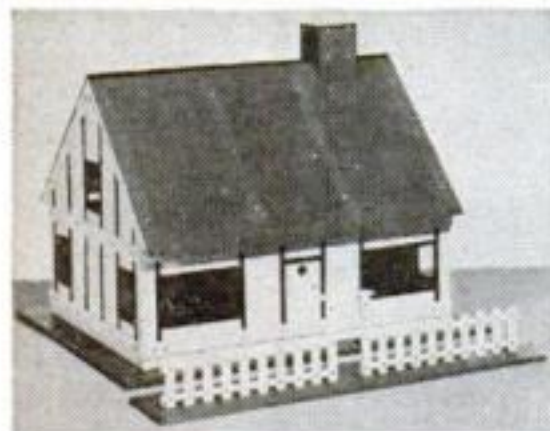
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Here's how to **DOUBLE** the use and enjoyment you get from your Home Workshop! In this brand-new book, experts reveal know-how knacks of woodworking craftsmanship with both hand and power tools that will enable you to build furniture, make money-saving home repairs and improvements, enjoy scores of **additional** workshop hobbies! 690 illustrations! Order this big, handsome workbench manual now! Pay postman only \$1.98 plus postage when book arrives. (Or, if you want special DeLuxe Edition, Buckram bound, stamped in brilliant aluminum foil, pay only \$2.73.) Use it a **whole week**. Then, if not fully convinced it can **DOUBLE** the value of your Home Workshop to you, you may return it for refund of every penny! Write:

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"Radio For The Millions" Shows HOW TO BUILD 78 RADIOS—PHONOGRAPHS—OTHER SETS!

This giant book brings you 648 picture-diagrams plus *complete instructions* for building 78 radios and phonographs! Imagine! . . . 192 pages of step-by-step details on building an 8-tube FM set, a 2-way radio station, bicycle radio, floor lamp set, vest pocket portable, midget AC-DC set, superhet, high-fidelity amplifier, all wave receiver, home recorder, etc. What's more, there are scores of handsome cabinet suggestions, a dual turntable phonograph, tube tester and full details on "trouble-shooting"! So order now—send no money! When book arrives, pay postman only \$1.49 plus postal charges for handsomely bound Regular edition. If after 7 days' *Free Trial* you aren't delighted, return it for full refund. Be sure to send your order today to:—

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McCurley's **NEON** UNIT **Easy** TO SELL EVERYWHERE TO INSTALL ANYWHERE

10 SEPARATE 5-FOOT LENGTHS ALL TOP QUALITY FLUORESCENT NEON TUBING—CHOICE 6 COLORS

- 10 Separate 5-foot lengths of ALL TOP QUALITY fluorescent NEON TUBING—your choice of any combination of colors—RED, GREEN, BLUE, ROSE, GOLD and WHITE. All new tubing, full length, pumped, sealed and tested before shipping.
- 50 feet high tension cable. All new top quality.
- 1 large transformer. Guaranteed top quality, new, not rebuilt.
- 32 tube supports. All top quality.
- 45 lengths of copper wire. New, top quality.
- 36 cadmium plated screws for attaching wire and tubing. Top quality.
- 2 large screws for transformer attachment. New top quality.
- 1 set of simple diagram instructions for any type installation.

ITEMS 4, 5, and 6, are ample for installing the unit. Extras are included as protection to you in case of loss.

TERMS: F.O.B. Pensacola, Florida. **SHIP-ING WEIGHT:** 75 lbs. \$16.65 Cash with order for each unit, Balance C.O.D. 2% discount for all cash with order.

1 or 100 UNITS READY FOR IMMEDIATE SHIPMENT.



ORDER BLANK

T. D. McCURLEY 409 Fifth Street, Pensacola, Fla. Date: _____

Send me immediately _____ 50 FOOT NEON UNIT COMPLETE

I enclose herewith \$16.65 () CHECK OR () MONEY ORDER as deposit for each unit ordered, and I will pay the balance of \$38.35 for each unit C.O.D.

CHECK NO. UNITS _____ SPECIFY COLORS: _____ ROSE _____ RED _____ GOLD _____ BLUE _____ WHITE _____ GREEN.

SHIP BY () Express—F.O.B. Pensacola, Fla. () Freight—F.O.B. Pensacola, Fla.

BE SURE THAT YOUR NAME AND ADDRESS IS CORRECTLY GIVEN

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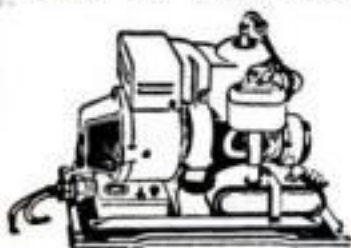
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RADIOMEN'S HEADQUARTERS * WORLD WIDE MAIL ORDER SERVICE!

General Electric 15 Tube Transmitter and Receiver

This brand new 15 tube transmitter-receiver was designed for mobile service on 12 volts, and will operate in the "Citizens' Band," where no amateur license to transmit is necessary. It's a cinch for any experimenter to connect this unit for 110 VAC operation by following the instructions and diagrams supplied, which cover numerous applications, including television. For those intending to use on car or boat, a new dynamotor, exactly as originally supplied, costs only \$15.00. Don't fail to write for FREE descriptive bulletin, RT 1248 for only \$29.95, or two for \$53.90.

OUR PE 109 DIRECT CURRENT POWER PLANT



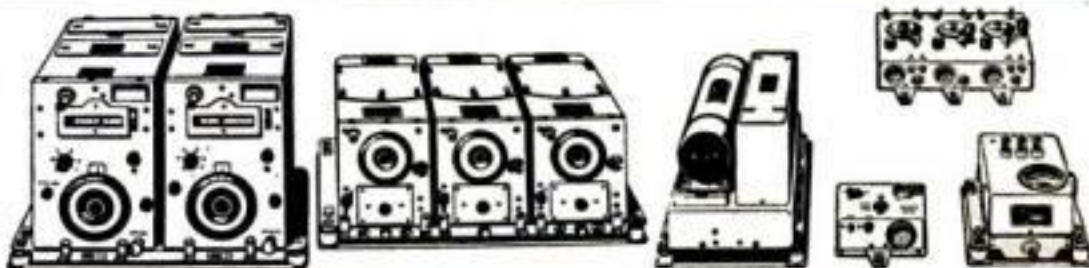
This power plant consists of a gasoline engine that is coupled to a 2000 watt 32 volt DC generator. This unit is ideal for use in locations that are not serviced by commercial power or to run many of the surplus items that require 24-32v-DC for operation. The price of this power plant tested and in good condition is only \$79.95 F. O. B. Buffalo, or we can supply strictly "as is" condition for \$58.95 F. O. B. New York City. These latter are exactly as received in heavy steel-strapped gov't.

cases and we are unable to determine if the individual units are new or used or what the condition is if used. The \$79.95 units are some of the same that we have brought to Buffalo for testing and repair if necessary. We do not recommend gambling on the "as is" condition, except for quantity purchasers. We can also supply a converter that will supply 110V AC from the above unit \$12.95 or from any 32V DC source for.....

SCR-274N COMMAND SET

The greatest radio equipment value in history

A mountain of valuable equipment that includes 3 receivers that use plug-in coils, and consequently can be changed to any frequencies desired without conversion. Also included are two Tuning Control Boxes; 1 Antenna Coupling Box; four 28V Dynamotors (easily converted to 110V operation); two 40-Watt Transmitters including crystals, and Preamplifier and Modulator, 29 tubes supplied in all. Only a limited quantity available, so get your order in fast. Removed from unused aircraft and in guaranteed electrical condition. A super value at \$34.95, including crank type tuning knobs for receivers.



HEAT GUN

Streamlined pistol grip heat gun in vivid red housing, that delivers a powerful 20 Cubic Ft. per minute blast of hot air at 160 Fahrenheit. Ordinary blowers have small fan motors, but this has a lifetime-lubricated AC-DC motor of the rugged vacuum cleaner type, that produces a hurricane of either hot or cold air. Perfect for blowing out dirt or dust from radio chassis, drying out ignition systems, warming up carburetors, quick-drying paint, thawing out radiators or water pipes, etc. Warning:—Keep this away from your wife, or she will be using it to dry her hair because it will do it in half the time of her ordinary hair dryer, to say nothing of her using it to dry stockings or clothing, or defrost the refrigerator instantly. Only \$12.95. Satisfaction guaranteed or money refunded if returned prepaid within 5 days.



SENSATIONAL VALUE IN AC-DC POCKET TESTER

This analyzer, featuring a sensitive repulsion type meter housed in a bakelite case, represents the culmination of 15 years achievement in the instrument field by a large company specializing in electronic test equipment.

Specifications of the AC-DC Model Volt-Ohm-Milliammeter:

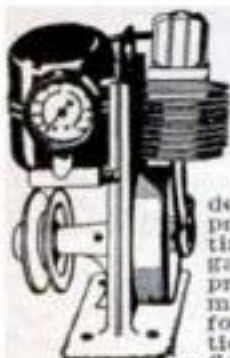
- AC Volts—0-25, 50, 125, 250
- DC Volts—0-25, 50, 125, 250
- Milliamperes AC—0 to 50
- DC Milliamperes—0 to 50
- Ohms Full Scale—100,000
- Ohms Center Scale—2400
- Capacity—.05 to 15 Mfd.

Total Price, prepaid anywhere in the USA—\$7.00.

Similar DC Meter, lacking the AC operated ranges of above, \$5.50 prepaid.



COMPRESSED AIR INSTANTLY, Anywhere!!

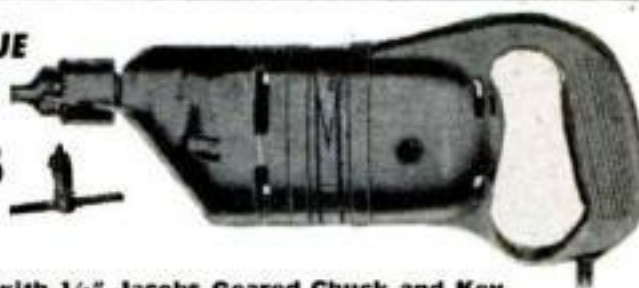


Portable Air Compressor and storage tank. Ruggedly built of best materials using lifetime lubricated ball-bearing on connecting rod and oil impregnated main bearing on shaft. Unusual design forever eliminates valve trouble, the most common fault in air compressors. PATENTED unique air intake system increases efficiency tremendously over other compressors so that air output is much greater than that from larger compressors powered by heavier motors. Will deliver appr. 3500 cu. in. air per min. at maintained pressure of 30 lbs., or will inflate a 90 lb. truck tire in less than 1 min. Complete with 100 lb. gauge, fingertip adjustment allows setting of output pressure at any value, which will automatically be maintained. Works from any 1/4 H.P. motor. Useful for spraying paints or lacquers, disinfectants, insecticides, annealing or brazing with natural gas, inflating tires, etc. Price \$14.50 postage prepaid anywhere in U.S. Efficient, adjustable syphon type spray gun complete with 12 ft. of 100 lb. tested hose for only \$7.75 with pint container, also prepaid.

TERRIFIC VALUE

ONLY

\$20⁹⁵



Equipped with 1/4" Jacobs Geared Chuck and Key

PORTABLE ELECTRIC DRILL

(Sold at less than established factory price so we cannot mention brand name)

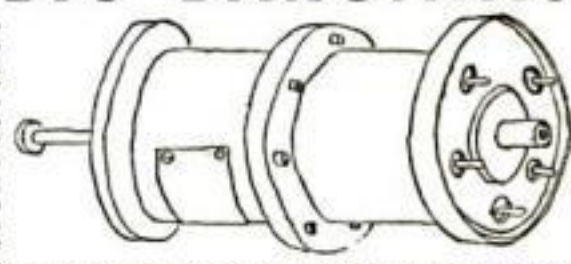
Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch, natural grip handle, and balance like a six shooter. Precision cut gears—turbine type cooling blower—extra long brushes. No stalling under heaviest pressure because of powerful 110 Volt AC or DC motor and multiple ball bearing thrust. Other bearings self-aligning lifetime-lubricated Oilite type. Made for toughest year-in and year-out service in plant or on construction jobs. Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use.

Full refund (you pay transportation) if not pleased with drill after trial.

RT-1579 consists of a three stage (cascade 6SJ7's and 6F6 output stage) high gain, high fidelity amplifier with 60 cycle, 110V power supply on the same 13 1/2 x 14 1/4 chassis, which is protected by a substantial steel cover over tubes and parts. Made by Western Electric with typical quality components such as a husky power transformer and oil condensers, this unit is obviously intended to give years of trouble-free service with no more need for repairs than a telephone. Disconnecting one wire each, from the special input and output filters, will result in as high a fidelity amplifier as can be obtained. Your cost with tubes, diagram and parts list included—\$14.95.

\$10⁹⁵ TAKES ALL THREE BIG BARGAINS

1. SENSATIONAL, FASCINATING, MYSTERIOUS SELSYNS. Brand new Selsyns made by G. E. Company. Two or more connected together work perfectly on 110V AC. Any rotation of the shaft of one selsyn and all others connected to it will rotate exactly as many degrees in the same direction, following unerringly as if the units were connected together by shafting instead of wire. This is true whether you twist the shaft of the master unit a fraction of a revolution or many revolutions. Useful for indicating direction of weather vanes, rotating directional antennas, or controlling innumerable operations from a distance. Complete with diagram and instructions. Per Matched pair \$4.95.



2. ALUMINUM GEAR BOX 18x8x7 that contains two powerful electric motors and two matched gear trains, 62 gears in all varying in size from 1/2 to 4 inches in diameter. This unit is readily converted to rotate a beam antenna or for any other similar use \$3.00.

3. HOME WORKSHOP AT BARGAIN PRICE. Accurate and precise 2 speed guaranteed hobby lathe, the essential machine for the home workshop. Sturdy enough for light production work or factory standby service. Supplied with 56" of belting for connecting to any available electric motor or power take-off, such as on a jeep or tractor. Also included in this unbelievable offer are such accessories as a 1/2" drill chuck with specially hardened tool steel jaws, a 4" electric furnace high speed grinding wheel, a cotton buffing wheel with a large supply of buffing compound, and a 4" steel wire scratch brush. Your cost \$6.00. Sole export agent. Distributor inquiries invited.

All sales final and no returns unless otherwise specified in ad of item. Right reserved to change prices and specifications at any time.

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. PS BUFFALO 3, N. Y.

7 x 50 BINOCULARS

MADE TO RIGID MILITARY SPECIFICATONS

Brand New



Actual
Photograph
Ht. 7"
Wt. 39 oz.

\$44

With
COATED
Lenses
& Prisms

\$54

These magnificent 7x50 prism binoculars were obtained through the Supreme Commander of the Allied Powers. They have the brilliant luminosity, precise clarity, and wide, undistorted field of view obtainable only with a good large glass. Because 7x50 glasses give the highest performance obtainable they are now the official choice of the Army, Navy and Marine Corps. This is your opportunity to purchase a brand new 7x50 AT 1/2 OF THE USUAL COST. Lifetime construction, Lightweight aluminum body. Ultra-precise optics, sealed against moisture and dust. Unsurpassed by any other binoculars, regardless of price. Sold with a guarantee of complete satisfaction or money refunded.

Price Without Case		Price With Richly Finished Case & Straps	
7x50 Uncoated	7x50 Coated	7x50 Uncoated	7x50 Coated
\$44*	\$54*	\$48*	\$58*

*Plus 20% Federal Tax
WE PAY THE SHIPPING COST

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WindoStep*

FOR ALL OUTSIDE WINDOW WORK
... UPSTAIRS OR DOWN

Light, strong, easily handled and adjusted. 500-lb. test. Steel railing, substantial floor, rubber house protectors. Guaranteed. Pat. Pend. Territories open. Free folder. *T.M.

\$9.85 C. O. D. PLUS FEE
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- Test ALL Home Outlets
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**STAR
TEST-PLIERS**

- Locate Blown Fuses
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A must tool for electricians, maintenance men, home owners. Replaceable lamp inside Plier tests 110 to 250 Volts. Plier pulls fuses from 10 to 100 Amperes. Shockproof. Requires the use of only one hand. Can be obtained from General Electric or Westinghouse stores, local electric dealers or direct from us, postpaid.

A Useful Xmas Gift

Price \$2.75 without Leads, \$1.50 additional for Leads. Order TODAY.
STAR FUSE CO., 237 Canal St., New York 13, N. Y.



Aids to

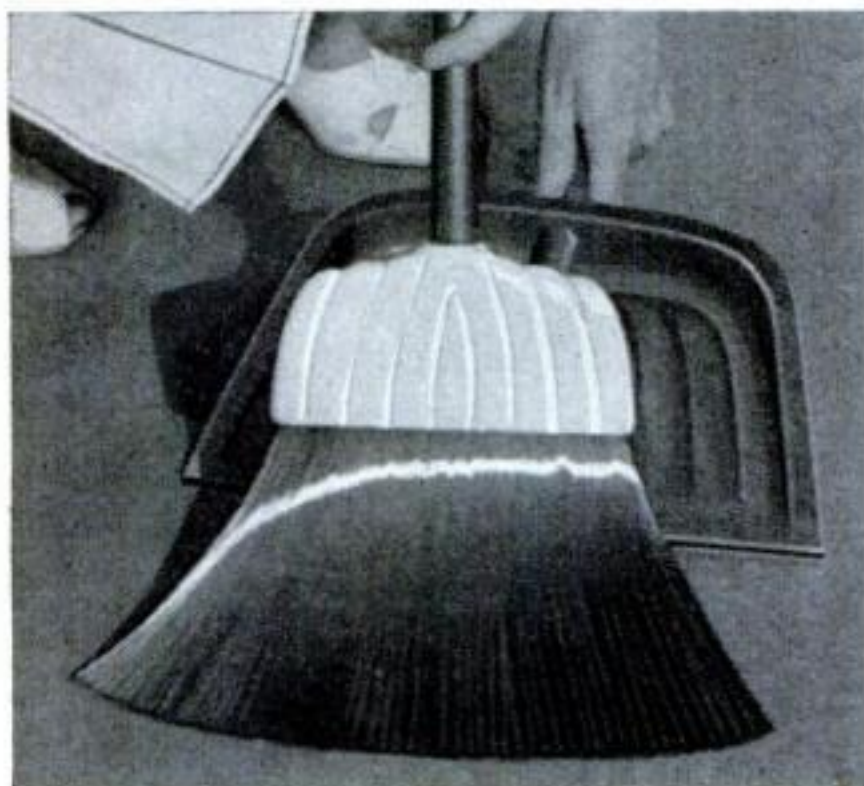


Two for One. Hinged at two points, this new double-decked waffle iron turns out two full-size waffles in the time ordinarily required to cook one. You just pour batter into the bottom section, let down the middle part, fill it with batter, and close the lid. It recently was put on the market by the Serva-Matic Co., of Chicago.



Skate Sharpener Fits Pocket. A small sharpener that gives ice-skate blades a hollow-ground edge is offered by the Beta Products Co., of Middle Village, N. Y. The gadget is 3/8" in diameter and 2 1/4" long and has a replaceable aluminum-oxide stone.

Modern Living



New Broom Sweeps Cleaner.

The bristles of this plastic broom may be kept crisp and shiny by washing in warm water. In addition, the maker, The Modglin Co., of Los Angeles, says the broom sweeps cleaner than the old-type broom because static electricity generated by the plastic bristles pulls dust from rugs and floors.



Atomizer Carried in Purse. This midget perfume atomizer loads from the bottom like a cigarette lighter and sends out a mist-like perfume spray when the button on top is pressed. H. Herzog & Co., of Chicago, prices it at about \$5.

JIFFY METAL CABINET with ALUMINUM or CARDBOARD DRAWERS



**SO HANDY
FOR SO MANY USES**

AT HOME, SHOP AND OFFICE

HANDY WAY TO KEEP SMALL PARTS, NUTS, WASHERS, BOLTS, NAILS, SCREWS, STAMPS, PHOTO SUPPLIES, HOBBYIST'S NEEDS, ETC.

Smart way to keep small items at home, office or at your work bench—The Jiffy metal cabinet: holds 32 or 64 spacious drawers (aluminum or heavy weight cardboard) that put small parts at your fingertips. Spot welded steel cabinet, enamel finish—metal flange drawer guides. Why fumble? With a Jiffy you know where it is. Order today for yourself or gift giving. Send check or money order—no C. O. D.'s please—prices listed below. Add 3% sales tax for Ohio orders.

WITH RUSTPROOF ALUMINUM DRAWERS

Solid one piece drawers—long service life. Satin finish. Ideal for shop and work bench needs.

32 DRAWER UNIT
\$8.95 POST PAID

64 DRAWER UNIT
\$15.95 POST PAID

SPECIFICATIONS

6" DEEP
12 $\frac{3}{4}$ " WIDE
15 $\frac{1}{4}$ " HIGH
DRAWER SIZE
1 $\frac{1}{4}$ " DEEP
2 $\frac{3}{4}$ " WIDE
6" LONG

6" DEEP
25 $\frac{1}{2}$ " WIDE
15 $\frac{1}{4}$ " HIGH
DRAWER SIZE
1 $\frac{1}{4}$ " DEEP
2 $\frac{3}{4}$ " WIDE
6" LONG

32 DRAWER UNIT
\$5.95 POST PAID

64 DRAWER UNIT
\$9.95 POST PAID

WITH HEAVYWEIGHT CARDBOARD DRAWERS

Suitable for most home uses. Heavy reinforced cardboard with kraft covering. Metal drawer pulls.

KAYTEE PRODUCTS

DEPT. S BOX 588 CANTON, OHIO



Stowaway

VISIBLE STORAGE FOR Small Parts—Nuts—Bolts —Nails—Screws

Out of the way—over the work bench. Quick and handy. Pull, push—no screw caps. Ideal for home work shop, electricians, jewelers, radio mechanics, garages, assembly plants, household and office. A fine gift. Made of heavy-gauge metal—durable and lasting. Holes drilled for under shelf or wall mounting. Metal roof protection from dust. All sizes are 17½ in. long. Individually packed. Use any standard food jar for replacement. **Dealer Inquiries Invited**

Your choice.....\$1.75 with jars
All 3 (with 17 jars).....\$4.95
Check or Money Order—Postage Pre-
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C.O.D. charge collect.
IMMEDIATE SHIPMENT GUARANTEED
Satisfaction Guaranteed or Full Refund

KILBURY MFG. CO. • Lawndale, Calif.

45

MINUTES PLAYING TIME ON EACH RECORD WITH THIS PORTABLE ELECTRIC DUAL DRIVE RADIO-PHONOGRAPH COMBINATION

The very last word in 1949 phono developments. Perfect for professional and home use. Eliminates bulky record changers. Absolutely fool-proof. Plays 10" and 12" records with lid closed. • Phonograph, use standard and LP micro-groove records with one pickup using simple replacement cartridge. • Microgroove records available everywhere. • Radio 5 tube superheterodyne—7 tube performance. • 4 x 6 oval speaker. • Uses new standard postwar miniature tubes. • Built-in loop antenna. • Radio operates on AC and DC—phonograph operates on AC only. • Weight of set 13 lbs. • Attractive two-tone alligator fabricoid in blue, maroon, green, dark brown and light brown—all fittings are solid polished brass.



• **\$69.95** •

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4500 Broadway New York 33, N. Y.

USE THE BRUSH YOUR BARBER USES

• Professional long-length pure white bristles. • Clear red catalin handle capped with a strong white ferrule. • A full-size brush 5" long, 1½" dia. • Years of shaving pleasure are yours with this Cass brush. Get a group together and buy a dozen for only \$10.00. Excellent value for club rooms, Y.M.C.A.'s, etc.....

\$1.00 postpaid

Dealers' inquiries invited

CASS BRUSH CO.
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PLASTIC TOPS

smooth
sparkling
surfaces



NOW . . . the Home Worker can cover his Sinks — Counters — Tables and Bars with colorful hardwearing decorative Laminates.

EASY TO APPLY

This tough, durable plastic comes in panels 1/16" thick and is the same superlative surface you have seen on modern kitchen tables, cabinets and in high-class restaurants. Ideal for splash panels in bathrooms and kitchens, too. Countless other uses.

This plastic top is washable—color-fast—highly resistant to stains, alcohol, abrasion and cigarette burns.

10 beautiful colors: Linens—tan, red, blue, green. Patterns—bleached mahogany, mother of pearl. Solid Colors—red, green, blue, yellow, black.

Shipped postage prepaid Price for **\$7.79**
Instructions for easy application included. east of Mississippi; west of the Mississippi add 90c per panel. Send check or money order. panel 30 x 48"

BANDT, INC. Dept. S-1, 37-17 33rd Street, Long Island City 1, N. Y.

292 POPULAR SCIENCE



Aids to Modern Living



Whipper Mounted in Bracket.

The Brac King Whipper® is easily set up or dismantled for storage by slipping it in or out of a bracket that screws to a table edge. A hinged joint at the top of the upright permits the blades to be swung up out of the way to remove a bowl. The National Die Casting Co., Chicago, is the maker.

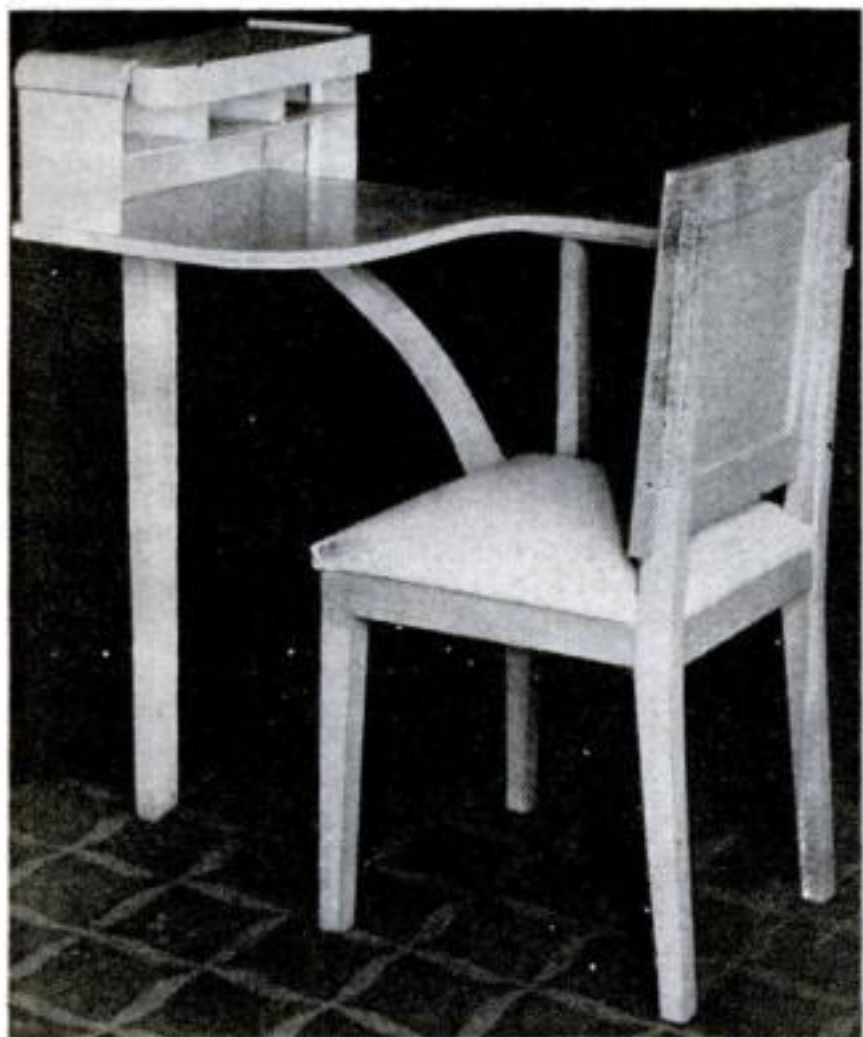


Drying Rack Folds Away.

The Quik Grip Drier®—for bathroom, laundry, or kitchen—features eight fold-away bars and 24 clothespin grips. When the 7" bars are folded up, the rack is 2" high and 9" long. Molded of plastic in five colors, the drier is priced at about \$2 by the Rochow Swirl Mixer Co., of Rochester, N. Y.



Now Toast Pops Down. This new electric toaster has wide openings at the top to take either bread or rolls. When done, the finished toast is automatically dropped out of the opening on the side. Delta Manufacturing Co., Philadelphia, is the maker.



Chair-Desk Combination. A built-in fluorescent lamp is a feature of this compact, modern desk and chair set offered by Stephen Nemes, of Chicago. The unit occupies very little space and may be bought in a wide range of colors, even in color combinations to match other furnishings in your home.

IT'S NEW THE PUTTY MASTER PLACES GLAZIERS SKILL IN YOUR HANDS



IT'S EASY

A putty knife with the patented shaper that anyone can operate—packs, shapes and trims putty perfectly with one stroke and allows only the right amount of putty to be applied—a time and money saving item that will more than pay for itself.

Only \$1.00 Postpaid
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I am enclosing \$1.00—please send me one Duo-Fast Putty Master.

PUTTY MASTER
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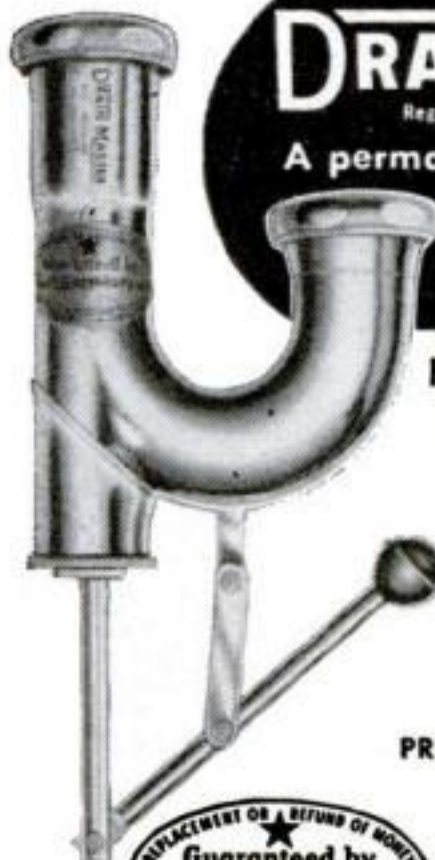
Goodbye to Clogged Sinks

Install

DRAIN-MASTER

Reg. U. S. Pat. Off.

A permanent fixture that clears
CLOGGED DRAINS
and keeps them clear.



Finger-tip action sets up a two-way hydraulic movement that quickly loosens obstructions and moves them down the drain. Finest materials and highest engineering specifications throughout.

PRICE \$6.95 (Model 501, to replace 1½" trap, as illustrated)



**SATISFACTION GUARANTEED
OR MONEY REFUNDED**

Write for free illustrated folder showing models for all sinks.

TELMOR PRODUCTS CORPORATION
1912 W. Lake Street, Chicago 12, Illinois

TO: *Reader*
FROM: *Editor*



Navy Aerobee rocket, 57 miles high, caught this panorama of the earth's surface. Mexico lies at the bottom, upper Wyoming at the top.



PS cover by Pioch, drawn in 1946 from imaginary perch 50 miles up, shows parts of New Mexico, Texas, Alabama, Mississippi, Louisiana.

Mind's Eye Scoops Camera

AS most of our readers know, the first question PS editors ask about a possible story is: "Where do you put the camera?"

More than two and a half years ago we asked that routine question about the "Wac Corporal's" research mission into the ionosphere (PS, May '46, p. 66). The answer we got was logical, but fantastic: "You put the camera 50 to 75 miles above the surface of the earth!" At that time neither POPULAR SCIENCE nor the Army nor the Navy nor the Air Forces knew how to do that.

So Ray Pioch (PS, July '46, p. 254), our engineer-artist and cover specialist, took over. With detailed maps superimposed on a large globe, together with a perceptive eye and sense of what's dramatic, Ray

worked out the panorama of the southwestern U.S.A. shown on the May 1946 cover.

His "camera eye," perched 50-odd miles in the air, caught visibly the earth's curvature, along with just the right hairlines, shadows, and dots identifying natural and man-made monuments.

Now comes the Navy and its collaborating experts from Johns Hopkins to give us a true photograph, on a grander scale. But Pioch's work suffers little by comparison—perhaps because he was able to work without the ground haze that obscures much of the Navy picture!

Fred Newman

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**THE SMOOTHEST RIDE
ON TWO WHEELS!**

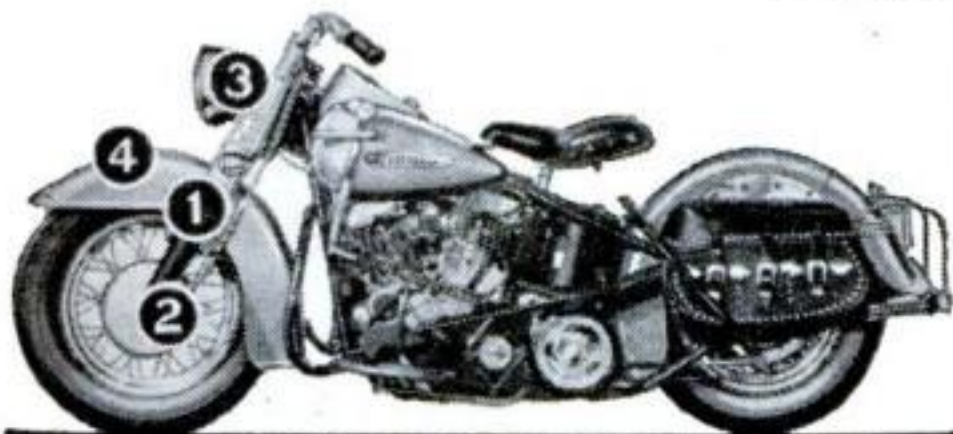
1949

HARLEY-DAVIDSON

with the New *HYDRA-GLIDE* FORK

- ① **NEW** Hydra-Glide Fork irons out bumps like magic!
- ② **NEW** powerful front brake takes hold at a touch!
- ③ **NEW** sealed ray headlight turns night into day!
- ④ **NEW** air flow fenders for streamlined beauty.

SMOOTH is the word for it . . . comfortably smooth, even on rough roads! Remarkably stable and easier than ever to handle. Takes off like a "jet-job" . . . amazing new performance! All this and more is yours in the New Harley-Davidson with the Hydra-Glide Fork. You'll ride with new road-hugging security, steer with new effortless ease, stop at a touch of the brakes, enjoy the great sport of motorcycling as never before! You'll enter a new world of motorcycling performance, as you thrill to the "flying-feel" of your Harley-Davidson wheeling you swiftly, securely and comfortably to exciting race meets, hillclimbs, endurance runs, sightseeing tours and faraway places. See your Harley-Davidson dealer today. Take a ride. Mail coupon now.



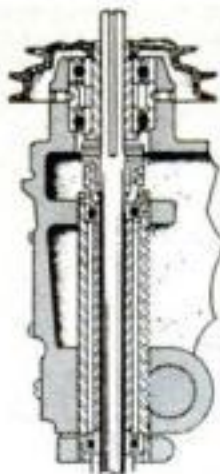
Harley-Davidson Motor Co.,
Dept. P5, Milwaukee 1, Wis.
Send literature on 1949 models, also
free copy of **ENTHUSIAST** Maga-
zine filled with motorcycle action
pictures and stories.

Name.....
Address.....
City..... State.....

Copyright 1948, Harley-Davidson Motor Co.

FOUR PRECISION BALL BEARINGS

Two on spindle, two on drive sleeve. Pre-lubricated and sealed precision type, no oiling required.



ADJUSTABLE QUILL RETURN SPRING

Retracts quill instantly upon release of feed lever. Tension of spring adjustable.



DEPTH GAUGE

Controls feed depth, length of return stroke, or locks spindle in any position. 16th graduations.



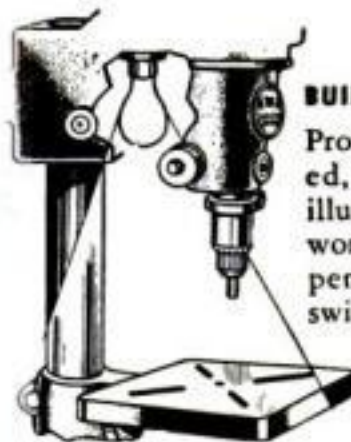
BELT TENSION RELEASE

Flip of lever removes tension from belt for easy speed changes. Proper belt tension maintained.



BUILT-IN LIGHT

Provides shielded, shadowless illumination on work area. Independent on-off switch is built-in.



INTERCHANGEABLE SPINDLES

Spindles available to take No. 2 Morse taper shank tools, and for 1/2" straight shank tools, router bits, shaper cutters, etc.



TABLE LOCK

Double-plug binder securely locks table to column. Eliminates misalignment. Column bearing is NOT split.



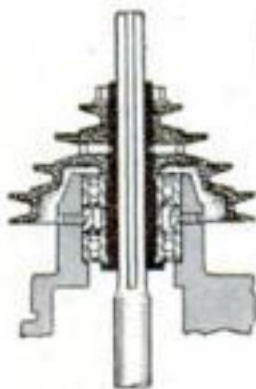
QUILL BEARING ADJUSTMENT

Shoe-type take-up provides feather-touch tension and secure locking. Quill bearing is NOT split.



FREE-FLOATING SPINDLE

Design prevents misalignment, side thrust and whip. Precision splines in spindle and sleeve.



CAPACITIES — SPECIFICATIONS

CAPACITY

Maximum drill size in iron or steel—1/2". Drills to center of 1 1/4" circle.

CHUCK

Capacity—0 to 1/2"

SPINDLE

Regular drill chuck type supplied. Travel.....4"

CHUCK TO BASE DISTANCE

Bench Model—17"
Floor Model—46 1/2"

SPINDLE SPEEDS

Four—655 to 4530 r.p.m.

TABLE SIZE

10" x 10". Tilts to any angle.

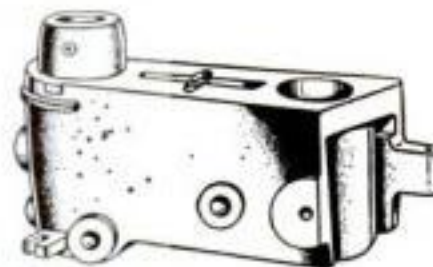
Bench Model

\$129³⁰

Floor Model

\$144³⁰

Prices, f.o.b. factory, include drill chuck and 1/3 h.p., 115 or 230 v., 1 ph., 60 cycle motor and switch.



ONE-PIECE HEAD CASTING

Insures perfect alignment. Double-plug binder locks the head to column. Column bearing is NOT split.



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Dependable

CHAMPION

America's Favorite Spark Plug



The Christmas tree harvest is on, bringing with it all that is implied by "Christmas spirit." Our Christmas spirit extends to the vast public we serve, for it is they who have made Champion America's Favorite Spark Plug. This preferred position is, we feel, due above all to Champion's inherent and traditional dependability, outstanding quality and value—marks which we pledge will always distinguish every spark plug to bear the name *CHAMPION*. Champion Spark Plug Company, Toledo 1, Ohio.



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How to focus your Camera for Photoflash Pictures

Here's another of the dozens of photography jobs your flashlight, packed with "Eveready" batteries, does for you.

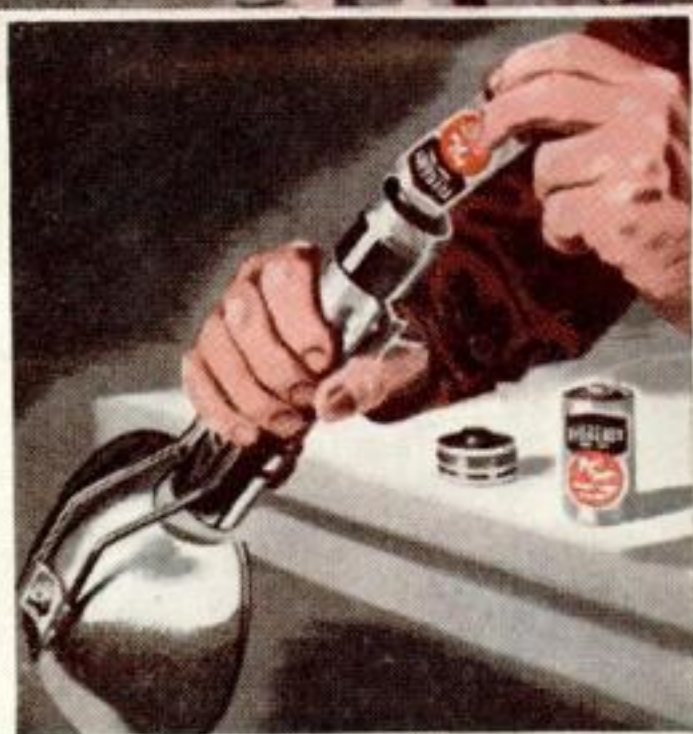
When you're taking photoflash pictures, it isn't easy to focus—or get good composition—in dim light. Prop your "Eveready" flashlight pointing at the subject to be photographed. Or, if somebody's around to help, have him hold it. Of course, once your picture is set, the flashlight should be turned off.



How to get longer life and brighter light in your flashlight



- Reload with "Eveready" batteries—they last longer, give brighter light—and they're the largest-selling flashlight batteries in the world!




IN THE PHOTOFLASH itself, be sure to use "Eveready" No. 950 flashlight batteries.

"EVEREADY" FLASHLIGHT BATTERIES

The trade-mark "Eveready" distinguishes products of
NATIONAL CARBON COMPANY, INC.

30 East 42nd Street, New York 17, N. Y.

Unit of Union Carbide  and Carbon Corporation